MECHANISMS in Modern Engineering Design

A Handbook for Engineers, Designers and Inventors

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Volume V

Hydraulic, Pneumatic and Electric Mechanisms

Part 1

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CONTENTS

PREFACE

This fifth and concluding volume of *Mechanisms in Modern Engineering Design*, published in two parts, deals with mechanisms based on hydraulic, pneumatic and electric devices. The first two types are presented in Part 1 and the third in Part 2. The mechanisms are accompanied by pertinent descriptions of their structure and the motions they perform. Data are given for certain of the mechanisms on the kinematic and dimensional relations of their links, etc. The schematic representations of the mechanisms are, so far as is practicable, in the same form as in the first four volumes. But, owing to specific features, it was found expedient to alter the methods for describing and depicting certain of the items.

These mechanisms have been systemized, as they were in the first four volumes, on the basis of their structural features, with a second classification—based on their service function—given parallel to the first classification.

Two tables, similar to those at the beginning of Volumes I, III and IV, enable the reader to readily locate the required mechanism, either by its structural features or by its service function. The mechanisms are additionally listed in alphabetical order in the subject index at the back of each part of Volume V. The indices of the subgroups are the same as in the first four volumes, but they have been supplemented by new subgroups given for the first time in the present volume.

The reader can find all the necessary information on how this handbook can be most efficiently used, on the conventions followed in the schematic representations and the description, as well as on other matters of this nature, in the preface and introduction published in the first volume.

Grateful acknowledgement is made of the assistance of the staff of the Theory of Machines and Mechanisms Department, USSR Polytechnical Correspondence Institute. Especial thanks are due to the Science Editor, N. V. Speransky, Cand.Sc.(Eng.) for his participation in preparing this and the preceding volumes for publication, and to E. V. Hertz, D.Sc.(Eng.) for her expert consultation and competent advice, and for all the material she so kindly made available.

Please send all comments on the shortcomings of this handbook, reports on errors found by readers, and suggestions for future changes and supplementary data to N. V. Speransky, Institute of Mechanical Engineering, Ul. Griboyedova 4, Moscow 101830, USSR. They will be appreciated.

I. I. Artobolevsky
(1905-1977)

Table 1

CLASSIFICATION OF MECHANISMS BASED ON STRUCTURAL FEATURES

Group No.	XXVIII			
Group name	Simple Hydraulic and Pneumatic Mechanisms			
Group index	SHP			
	No.	Name	Sub-group index	Mechanism No.
	1	Valve mechanisms	Va	3591 through 3634
	2	Damper and cataract mechanisms	DC	3635 through 3645
	3	Flow-control and directional valve mechanisms	FC	3646 through 3697
	4	Mechanisms of materials handling equipment	MH	3698, 3699 and 3700
	5	Mechanisms of measuring and testing devices	M	3701 through 3737
	6	Gripping, clamping and expanding mechanisms	GC	3738 through 3748
	7	Drive mechanisms	Dr	3749 through 3758
	8	Brake mechanisms	Br	3759 through 3763
	9	Relay mechanisms	Re	3764 and 3765
	10	Regulator mechanisms	Rg	3766 and 3767
	11	Mechanisms of other functional devices	FD	3768 through 3786

Group No.	XXIX			
Group name	Lever-Type Hydraulic and Pneumatic Mechanisms			
Group index	LHP			
	No.	Name	Sub-group index	Mechanism No.
	1	Rotary vane and piston pump mechanisms	RP	3787 through 3850
	2	Gripping, clamping and expanding mechanisms	GC	3851 through 3892
	3	Regulator mechanisms	Rg	3893 through 3913
	4	Flow-control and directional valve mechanisms	FC	3914 through 3925
	5	Mechanisms of measuring and testing devices	M	3926 through 3942
	6	Damper and cataract mechanisms	DC	3943 through 3947
	7	Drive mechanisms	Dr	3948 through 3953
	8	Valve mechanisms	Va	3954 through 3959
	9	Control mechanisms	Co	3960 through 3968
	10	Mechanisms of materials handling equipment	MH	3969
	11	Hammer, press and die mechanisms	HP	3970, 3971 and 3972
	12	Clutch and coupling mechanisms	C	3973
	13	Mechanisms of other functional devices	FD	3974 through 3989
Group No.	XXX			
Group name	Toothed Hydraulic and Pneumatic Mechanisms			
Group index	THP			
	No.	Name	Sub-group-index	Mechanism No.
	1	Rotary vane and piston pump mechanisms	RP	3990 and 3991
	2	Gear and other rotary pump mechanisms	GP	3992 through 4015

Table 1 (continued)

Group No.	XXX			
Group name	Toothed Hydraulic and Pneumatic Mechanisms			
Group index	THP			
	No.	Name	Sub-group index	Mechanism No.
	3	Mechanisms of measuring and testing devices	M	4016 through 4021
	4	Gripping, clamping and expanding mechanisms	GC	4022 through 4028
	5	Drive mechanisms	Dr	4029 through 4035
	6	Brake mechanisms	Br	4036
	7	Speed-change and reducing gear mechanisms	SR	4037 and 4038
	8	Mechanisms of other functional devices	FD	4039, 4040 and 4041
Group No.	XXXI			
Group name	Elastic-Link Hydraulic and Pneumatic Mechanisms			
Group index	EHP			
	No.	Name	Sub-group index	Mechanism No.
	1	Valve mechanisms	Va	4042 through 4049
	2	Mechanisms of measuring and testing devices	M	4050 through 4083
	3	Regulator mechanisms	Rg	4084 through 4113
	4	Gripping, clamping and expanding mechanisms	GC	4114 and 4115
	5	Rotary vane and piston pump mechanisms	RP	4116 through 4120
	6	Drive mechanisms	Dr	4121, 4122 and 4123
	7	Control mechanisms	Co	4124 and 4125
	8	Mechanisms of other functional devices	FD	4126 through 4129

Table 1 (continued)

Group No.	XXXII			
Group name	Complex Hydraulic and Pneumatic Mechanisms			
Group index	CHP			
	No.	Name	Sub-group index	Mechanism No.
	1	Drive mechanisms	Dr	4130 through 4224
	2	Regulator mechanisms	Rg	4225 through 4274
	3	Hammer, press and die mechanisms	HP	4275 and 4276
	4	Aircraft landing gear mechanisms	AL	4277 through 4281
	5	Mechanisms of measuring and testing devices	M	4282
	6	Mechanisms of materials handling equipment	MH	4283 and 4284
	7	Gripping, clamping and expanding mechanisms	GC	4285 through 4293
	8	Brake mechanisms	Br	4294 through 4300
	9	Relay mechanisms	Re	4301
	10	Mechanisms of other functional devices	FD	4302 through 4310
Group No.	XXXIII			
Group name	Simple Electric Mechanisms			
Group index	SmE			
	No.	Name	Sub-group index	Mechanism No.
	1	Flow-control and directional valve mechanisms	FC	4311 through 4320
	2	Relay mechanisms	Re	4321 through 4334
	3	Mechanisms of measuring and testing devices	M	4335 through 4414
	4	Regulator mechanisms	Rg	4415, 4416 and 4417
	5	Clutch and coupling mechanisms	C	4418 through 4422

Table 1 (continued)

Group No.	XXXIII			
Group name	Simple Electric Mechanisms			
Group index	SmE			
	No.	Name	Sub-group index	Mechanism No.
	6	Stop, detent and locking mechanisms	SD	4423 and 4424
	7	Switching, engaging and disengaging mechanisms	SE	4425 through 4430
	8	Mechanisms for mathematical operations	MO	4431
	9	Mechanisms of other functional devices	FD	4432 through 4450
Group number	XXXIV			
Group name	Lever-Type Electric Mechanisms			
Gronp index	LE			
	No.	Name	Sub-group index	Mechanism No.
	1	Relay mechanisms	Re	4451 through 4478
	2	Regulator mechanisms	Rg	4479 through 4488
	3	Mechanisms of measuring and testing devices	M	4489 through 4516
	4	Stop, detent and locking mechanisms	SD	4517, 4518 and 4519
	5	Drive mechanisms	Dr	4520 and 4521
	6	Sorting and feeding mechanisms	SF	4522 through 4530
	7	Brake mechanisms	Br	4531 through 4536
	8	Switching, engaging and disengaging mechanisms	SE	4537 through 4560
	9	Mechanisms of other functional devices	FD	4561 through 4573

Table 1 (continued)

Group number	XXXV			
Group name	Toothed Electric Mechanisms			
Group index	TE			
	No.	Name	Sub-group index	Mechanism No.
	1	Relay mechanisms	Re	4574 through 4592
	2	Mechanisms of measuring and testing devices	M	4593 through 4601
	3	Regulator mechanisms	Rg	4602 through 4606
	4	Sorting and feeding mechanisms	SF	4607
	5	Control mechanisms	Co	4608
	6	Drive mechanisms	Dr	4609 through 4624
	7	Clutch and coupling mechanisms	C	4625
	8	Stop, detent and locking mechanisms	SD	4626 and 4627
	9	Mechanisms of other functional devices	FD	4628 through 4637
Group No.	XXXVI			
Group name	Complex Electric Mechanisms			
Group index	CE			
	No.	Name	Sub-group index	Mechanism No.
	1	Relay mechanisms	Re	4638 through 4645
	2	Mechanisms of measuring and testing devices	M	4646 through 4704
	3	Mechanisms for mathematical operations	MO	4705 and 4706

Table 1 (continued)

Group No.	XXXVI			
Group name	Complex Electric Mechanisms			
Group index	CE			
	No.	Name	Sub-group index	Mechanism No.
	4	Flow-control and directional valve mechanisms	FC	4707 and 4708
	5	Regulator mechanisms	Rg	4709 through 4719
	6	Drive mechanisms	Dr	4720 through 4726
	7	Sorting and feeding mechanisms	SF	4727 through 4731
	8	Clutch and coupling mechanisms	C	4732, 4733 and 4734
	9	Brake mechanisms	Br	4735
	10	Mechanisms of other functional devices	FD	4736 through 4745

No.	Subgroup index	Subgroup name	Group	
			SHP	LHP
1	AL	Aircraft landing gear mechanisms		
2	Br	Brake mechanisms	3759 through 3763	
3	C	Clutch and coupling mechanisms		3973
4	Co	Control mechanisms		3960 through 3968
5	DC	Damper and cataract mechanisms	3635 through 3645	3943 through 3947
6	Dr	Drive mechanisms	3749 through 3758	3948 through 3953
7	FC	Flow-control and directional valve mechanisms	3646 through 3697	3914 through 3925
8	FD	Mechanisms of other functional devices	3768 through 3786	3974 through 3989
9	GC	Gripping, clamping and expanding mechanisms	3738 through 3748	3851 through 3892
10	GP	Gear and other rotary pump mechanisms		

Table 2

BASED ON FUNCTIONAL FEATURES

index						
THP	EHP	CHP	SmE	LE	TE	CE
		4277 through 4281				
4036		4294 through 4300		4531 through 4536		4735
			4418 through 4422		4625	4732 through 4734
	4124 and 4125				4608	
4029 through 4035	4121 through 4123	4130 through 4224		4520 and 4521	4609 through 4624	4720 through 4726
			4311 through 4320			4707 and 4708
4039 through 4041	4126 through 4129	4302 through 4310	4432 through 4450	4561 through 4573	4628 through 4637	4736 through 4745
4022 through 4028	4114 and 4115	4285 through 4293				
3992 through 4015						

No.	Subgroup index	Subgroup name	Group	
			SHP	LHP
11	HP	Hammer, press and die mechanisms		3970 through 3972
12	M	Mechanisms of measuring and testing devices	3701 through 3737	3926 through 3942
13	MH	Mechanisms of materials handling equipment	3698 through 3700	3969
14	MO	Mechanisms for mathematical operations		
15	Re	Relay mechanisms	3764 and 3765	
16	Rg	Regulator mechanisms	3766 and 3767	3893 through 3913
17	RP	Rotary vane and piston pump mechanisms		3787 through 3850
18	SD	Stop, detent and locking mechanisms		
19	SE	Switching, engaging and disengaging mechanisms		
20	SF	Sorting and feeding mechanisms		
21	SR	Speed-change and reducing gear mechanisms		
22	Va	Valve mechanisms	3591 through 3634	3954 through 3959

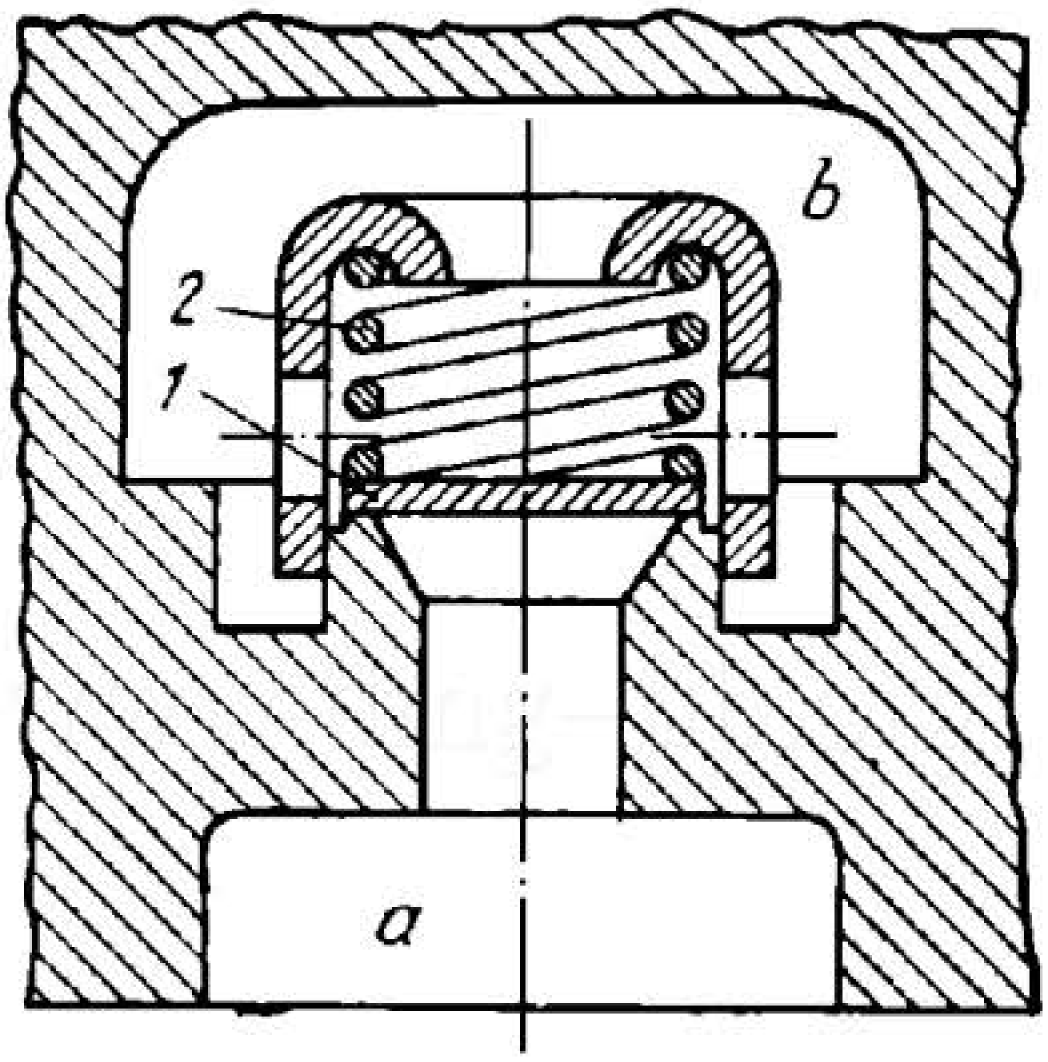
index						
THP	EHP	CHP	SmE	LE	TE	CE
		4275 and 4276				
4016 through 4021	4050 through 4083	4282	4335 through 4414	4489 through 4516	4593 through 4601	4646 through 4704
		4283 and 4284				
			4431			4705 and 4706
		4301	4321 through 4334	4451 through 4478	4574 through 4592	4638 through 4645
	4084 through 4113	4225 through 4274	4415 through 4417	4479 through 4488	4602 through 4606	4709 through 4719
3990 and 3991	4116 through 4120					
			4423 and 4424	4517 through 4519	4626 and 4627	
			4425 through 4430	4537 through 4560		
				4522 through 4530	4607	4727 through 4731
4037 and 4038						
	4042 through 4049					

SECTION TWENTY-EIGHT

Simple Hydraulic and Pneumatic Mechanisms SHP

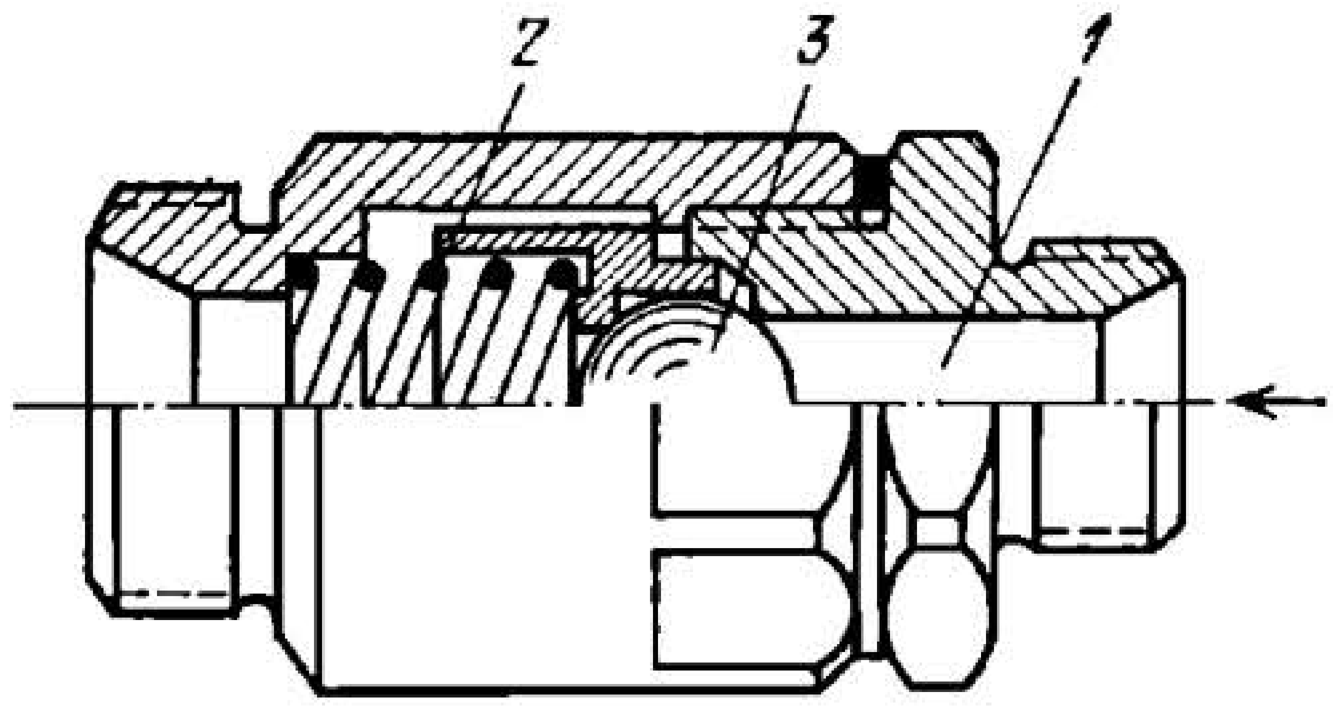
1. VALVE MECHANISMS (3591 through 3634)

3591	DISK-TYPE CHECK VALVE MECHANISM	SHP Va



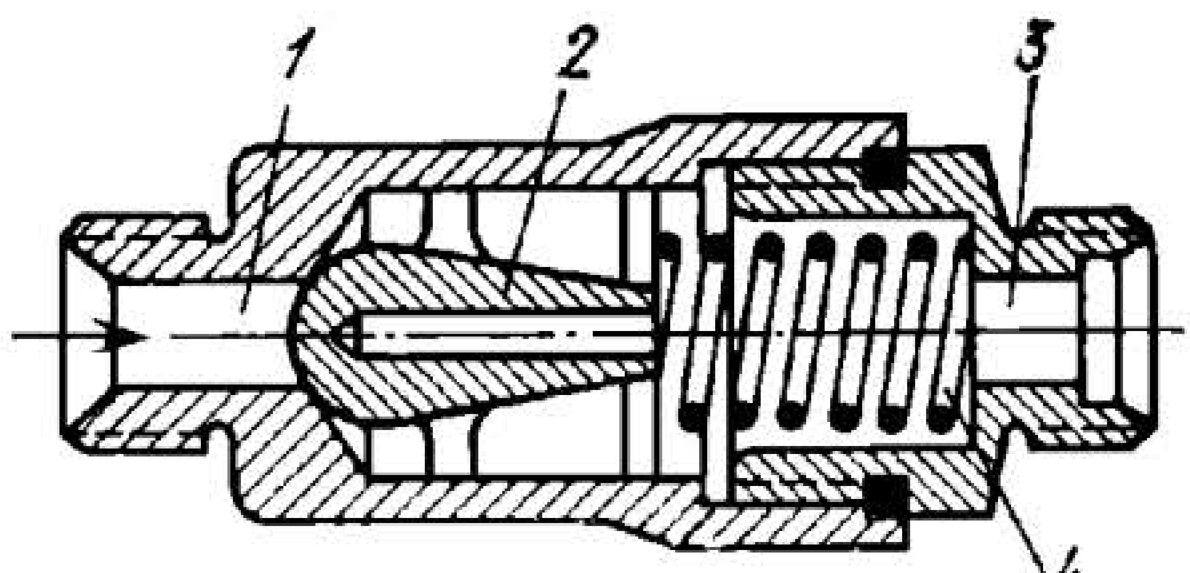
When the pressure in cavity *b* drops below that in cavity *a* by an amount equal to that for which the valve is designed, valve disk *1* is lifted, overcoming the resistance of spring *2* and allowing fluid to flow from cavity *a* into cavity *b*. As the difference in pressure is reduced, spring *2* returns disk *1* against its seat, cutting off the flow of fluid into cavity *b*.

3592	BALL-TYPE CHECK VALVE MECHANISM	SHP Va



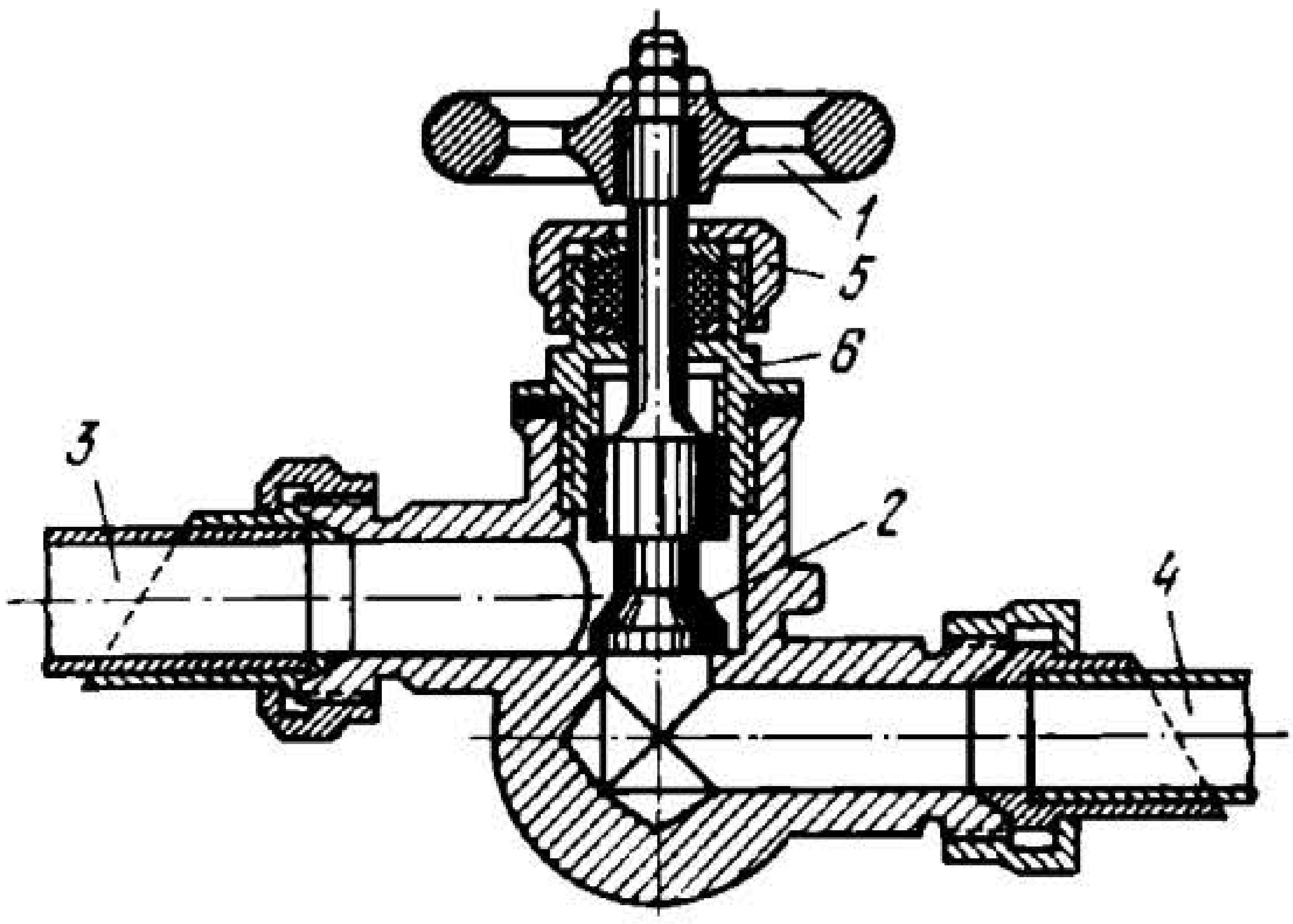
Fluid under pressure flows through inlet port *1* of the valve body to the left, overcoming the force exertet by helical spring *2* and pushing ball *3* off its seat. The valve prevents reverse flow of the fluid.

3593	STREAM-LINED CHECK VALVE MECHANISM	SHP Va



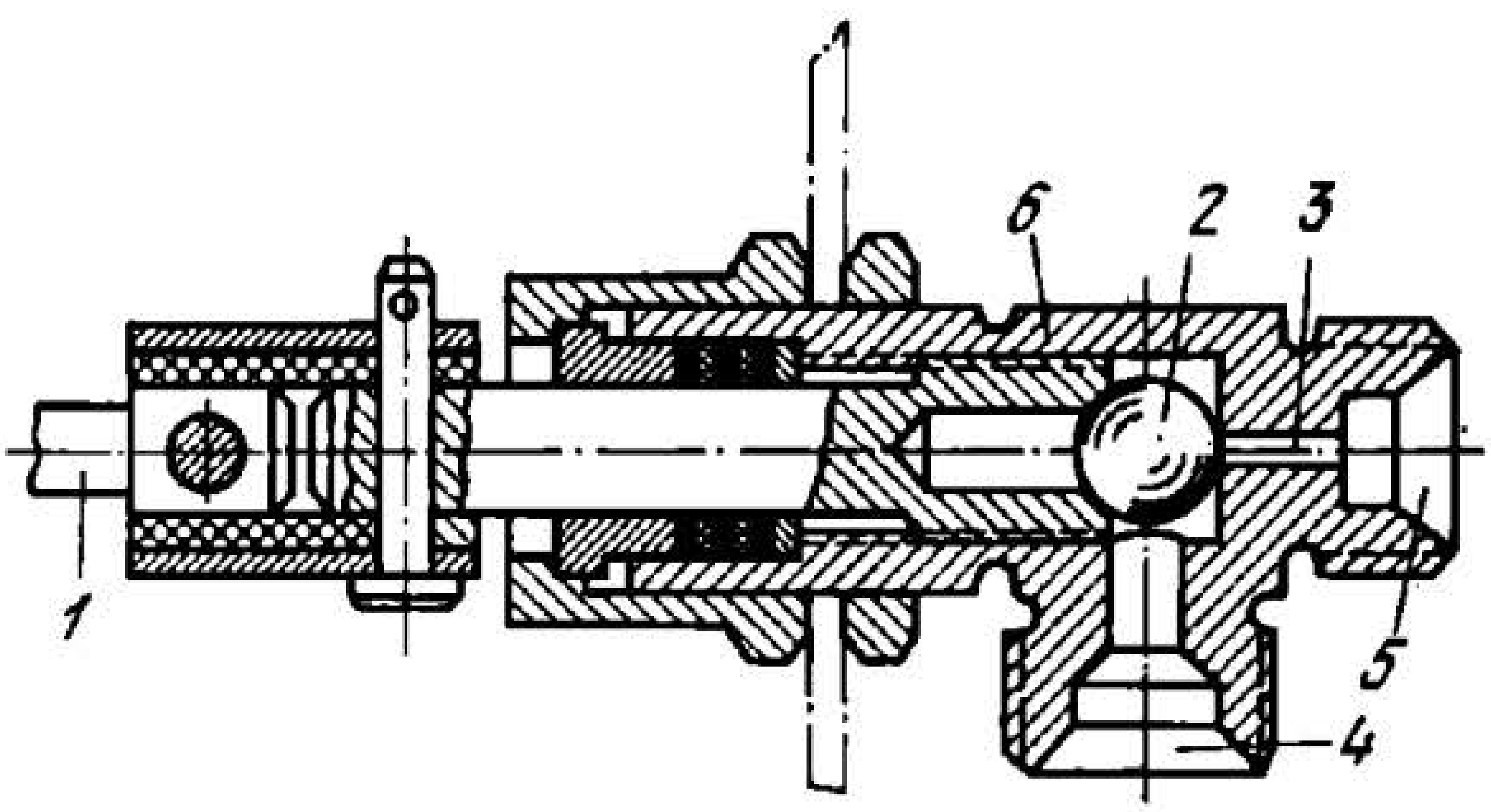
Fluid under pressure flows through inlet port *1* of the valve body to the right to outlet port *3*, overcoming the force exerted by helical spring *4* and pushing stream-lined valve member *2* off its seat. The valve prevents reverse flow of the fluid. Stream-lined member *2* offers little resistance to forward flow.

3594	SCREW OFFSET SHUTOFF GLOBE VALVE MECHANISM	SHP Va



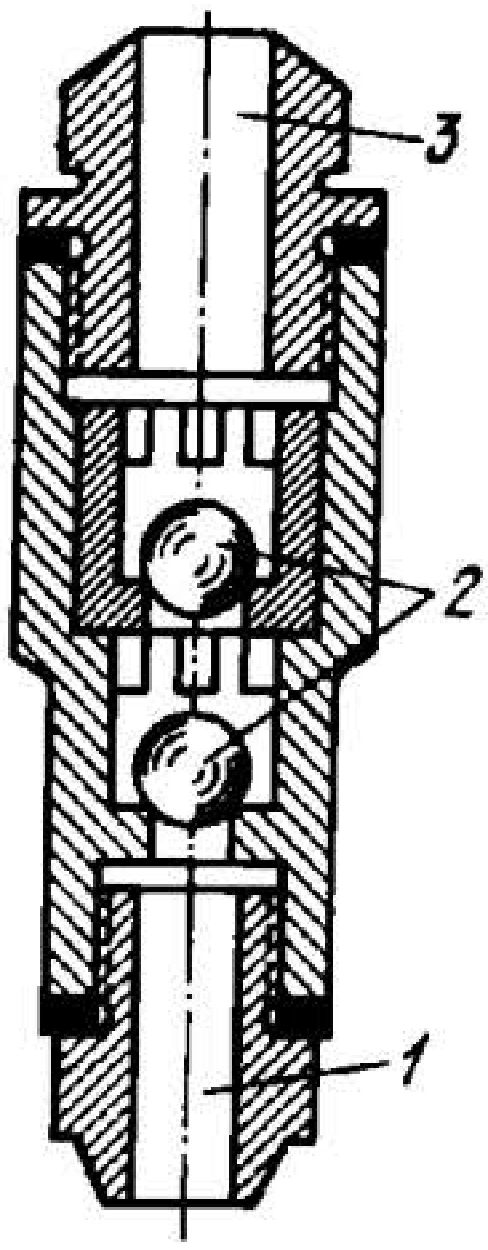
When handwheel *1* is turned clockwise, valve disk *2* is pressed tightly against its seat, shutting off the flow of fluid from channel *3* to channel *4*. Pack nut *5* is used to compress the packing in valve bonnet *6*.

3595	BALL-TYPE SCREW ANGLE SHUTOFF VALVE MECHANISM	SHP Va



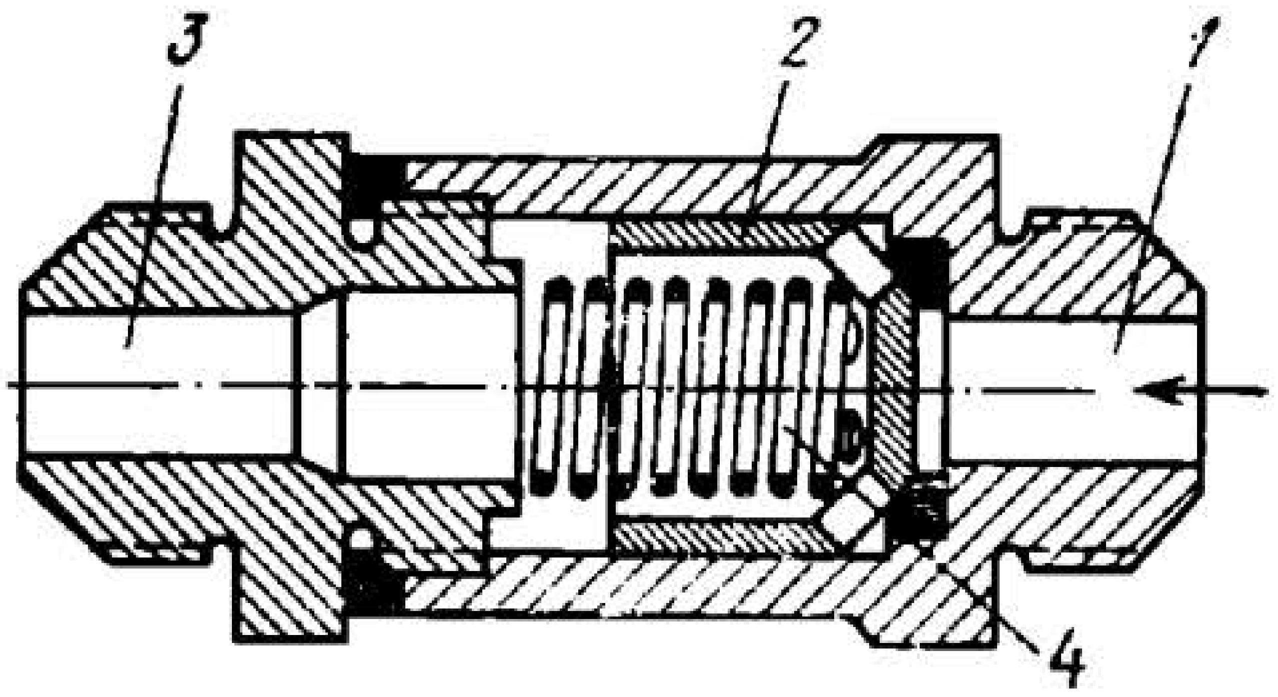
When link *1* is turned clockwise, screw member *6* is advanced to the right, pressing ball *2* tightly against hole *3* and shutting off the flow of fluid from port *4* to port *5* of the valve body.

3596	TWO-BALL CHECK VALVE MECHANISM	SHP Va



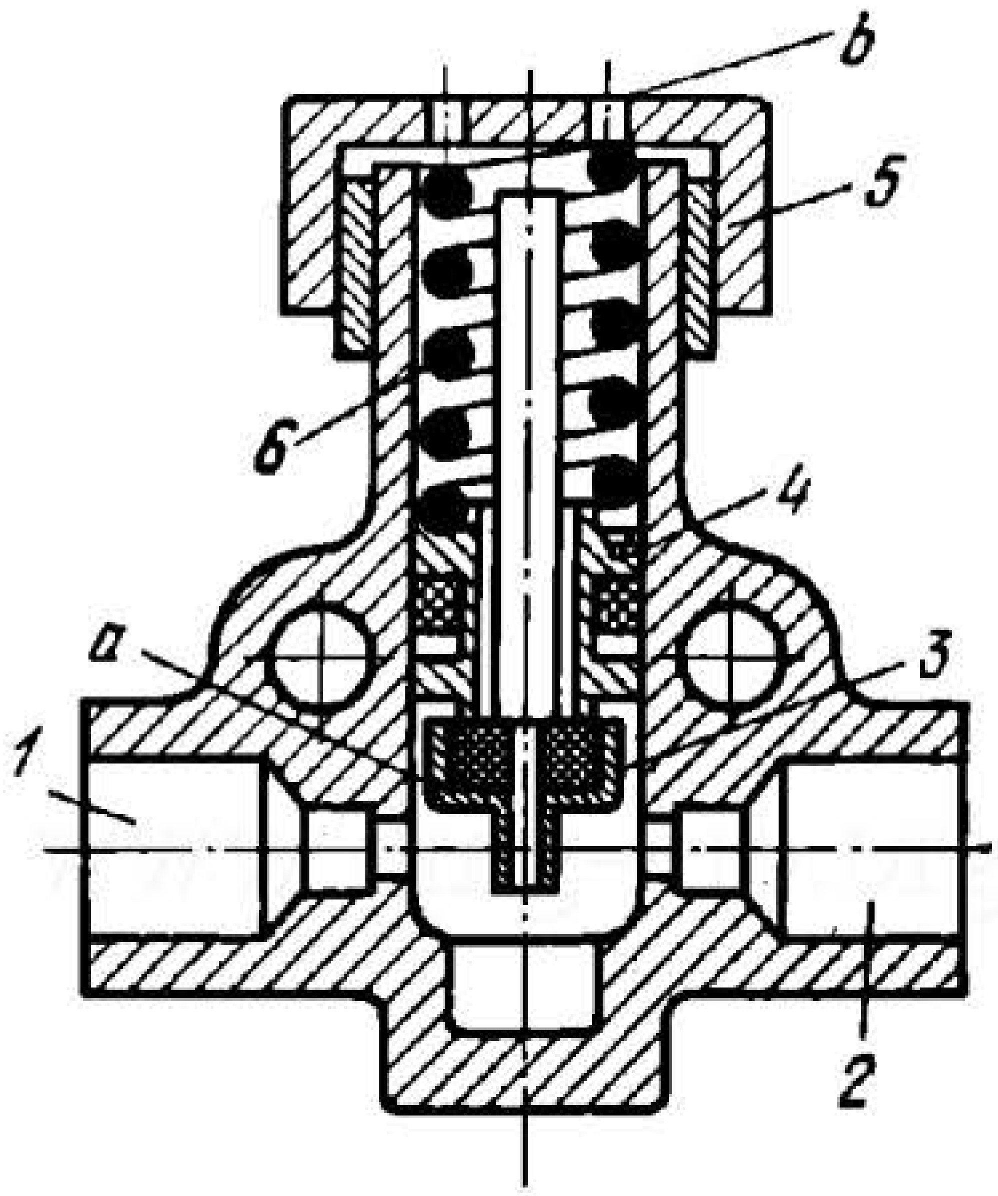
Fluid under pressure flows upward through inlet port *1*, overcoming the weights of balls *2* and pushing them off their seats, to outlet port *3*. Two balls are provided to prevent leakage and reverse flow more reliably.

3597	TAPER-SEAT CHECK VALVE MECHANISM	SHP Va



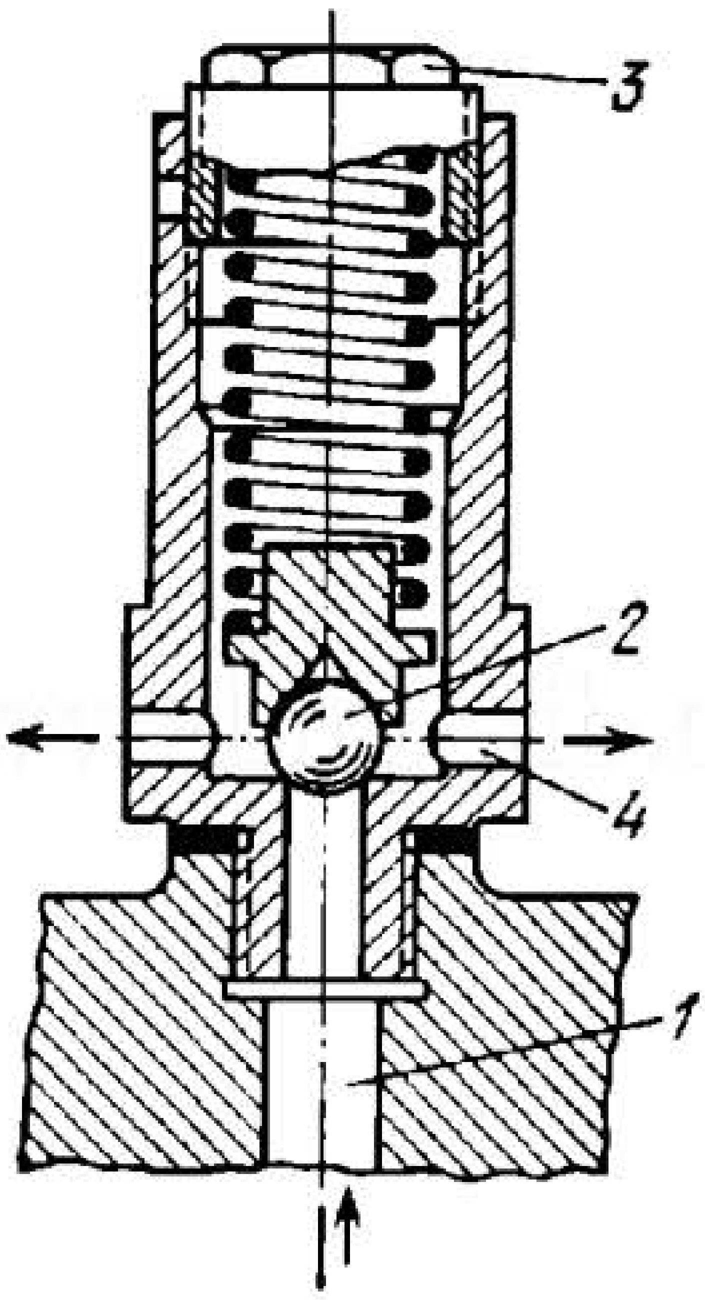
Fluid under pressure flows through inlet port *1* of the valve to the left to outlet port *3*, overcoming the force exerted by helical spring *4* and pushing sliding member *2* out of its seat. The valve prevents reverse flow of the fluid because member *2* is pressed tightly into its seat.

3598	SLIDING-SLEEVE RELIEF VALVE MECHANISM	SHP Va

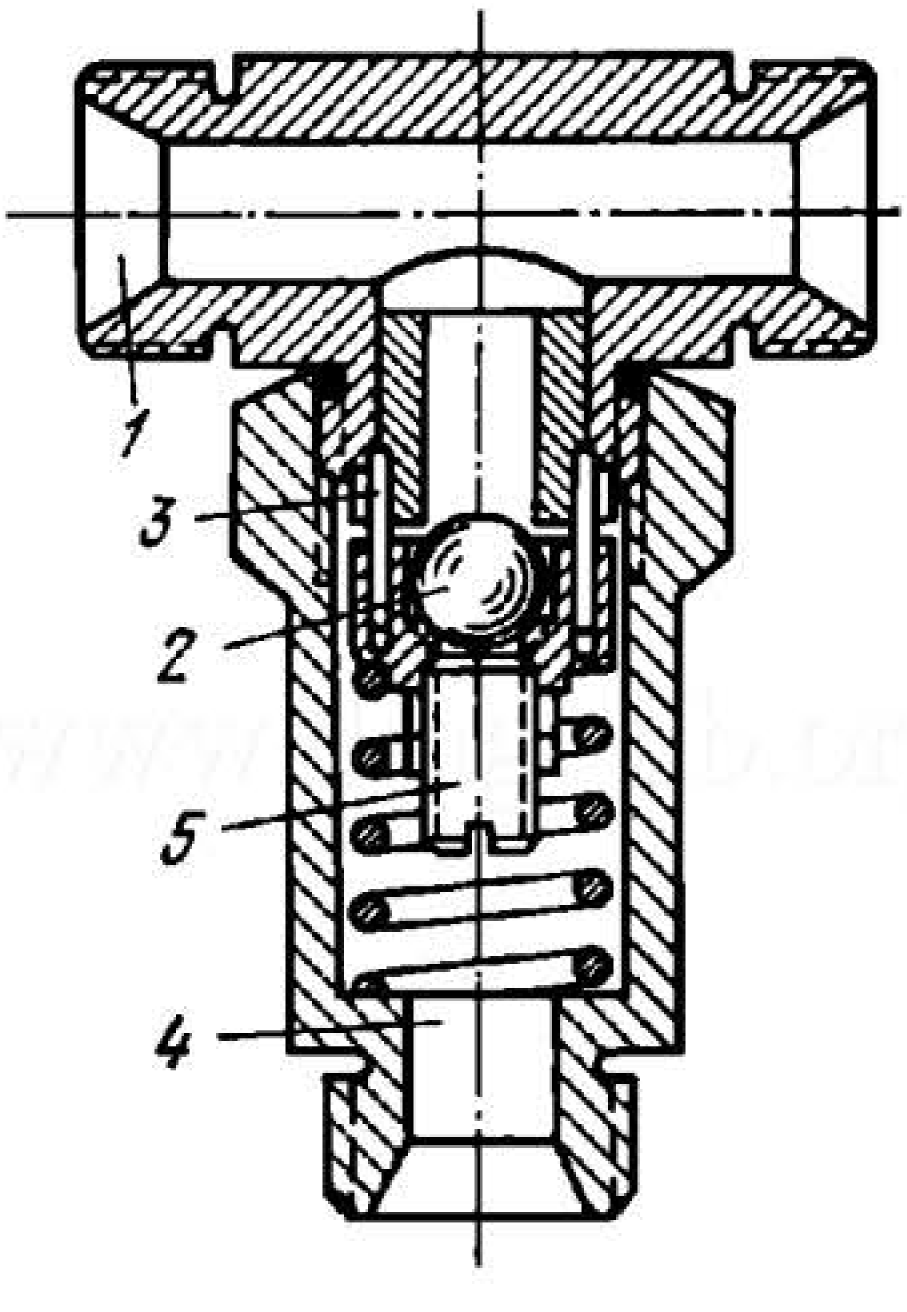


The valve is connected into a compressed air main with the air flowing through ports *1* and *2* of the valve body. When the pressure in the main increases, valve member *3* is pushed upward, compressing helical spring *6*, until the valve stem runs up against bonnet *5*. Upon a further increase in pressure, sleeve *4* slides upward, continuing to compress spring *6* and releasing air through clearance *a*, the clearance between sleeve *4* and the valve stem and holes *b* to the atmosphere. The force exerted by spring *6* (and the pressure at which the air is released) can be regulated by turning threaded bonnet *5*.

3599	BALL-TYPE RELIEF VALVE MECHANISM	SHP Va

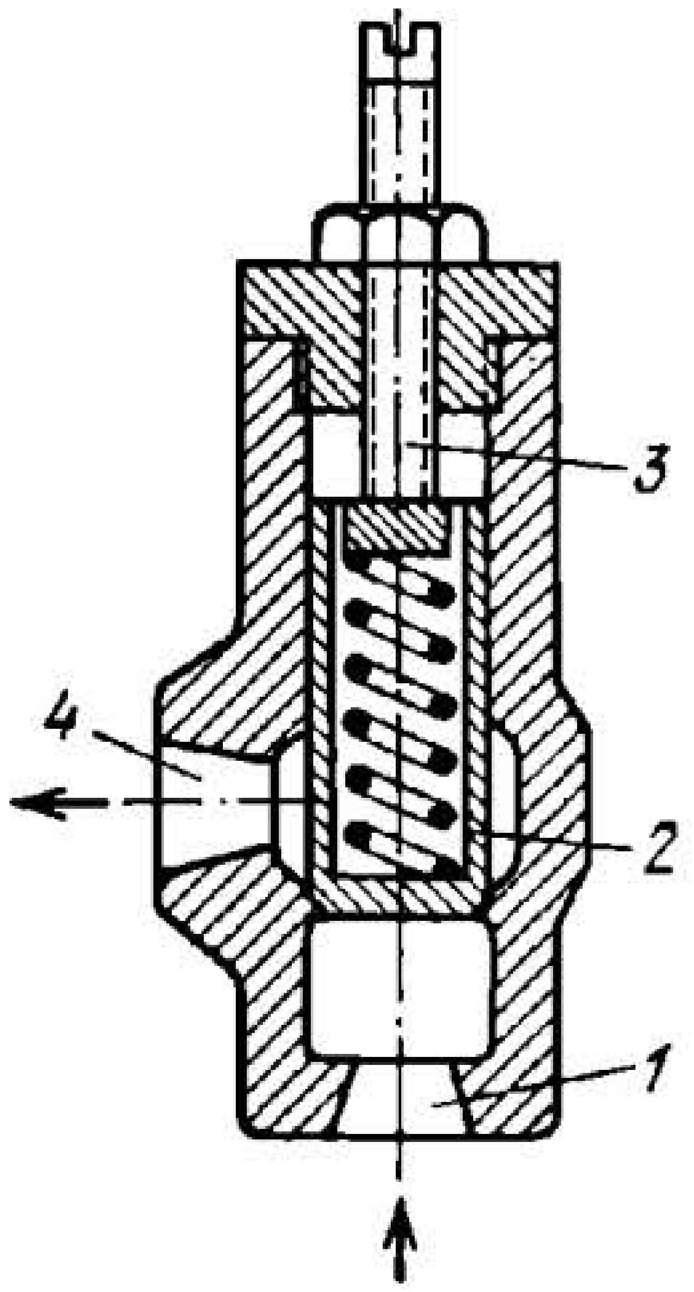


When the pressure of the fluid in passage *1* exceeds the preset value, controlled by the setting of the helical spring, ball *2* is lifted, overcoming the resistance of the spring and allowing the fluid to flow out through ports *4* into a receiver. The force exerted by the spring is regulated by screw member *3*.



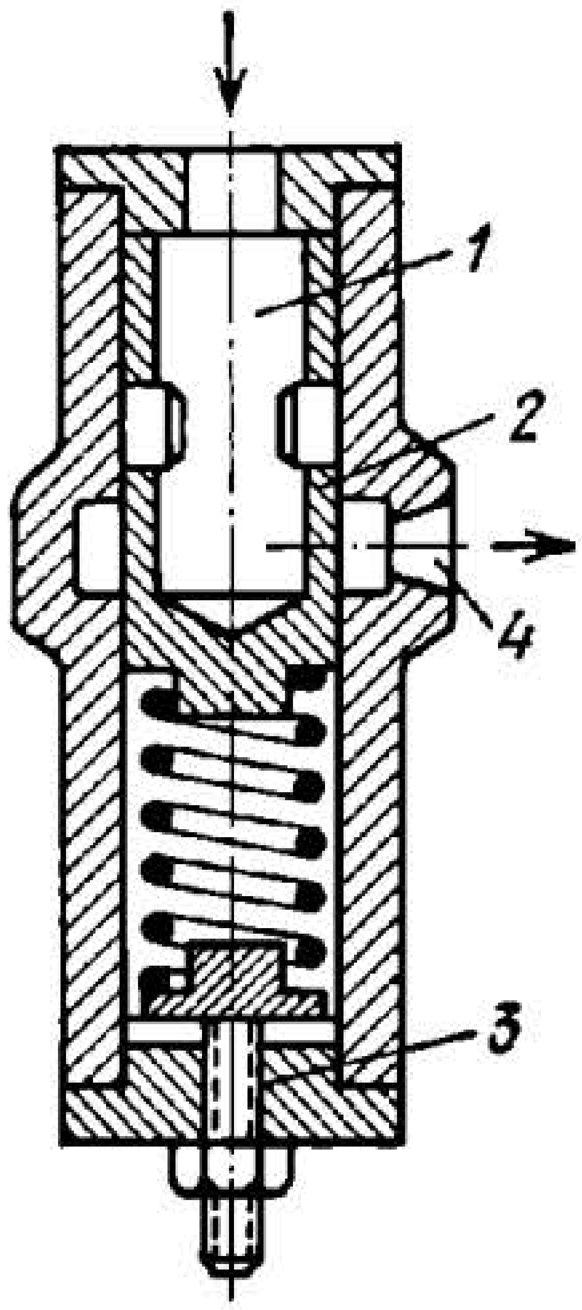
When the pressure of the fluid in port *1* exceeds the preset value, controlled by the setting of the helical spring, ball *2* is pushed out of its seat, together with its holding member, along guides *3*. This overcomes the force exerted by the spring and allows fluid to flow out through port *4*. The spring can be regulated by screw *5*.

3601	TAPER-SEAT RELIEF VALVE MECHANISM	SHP Va



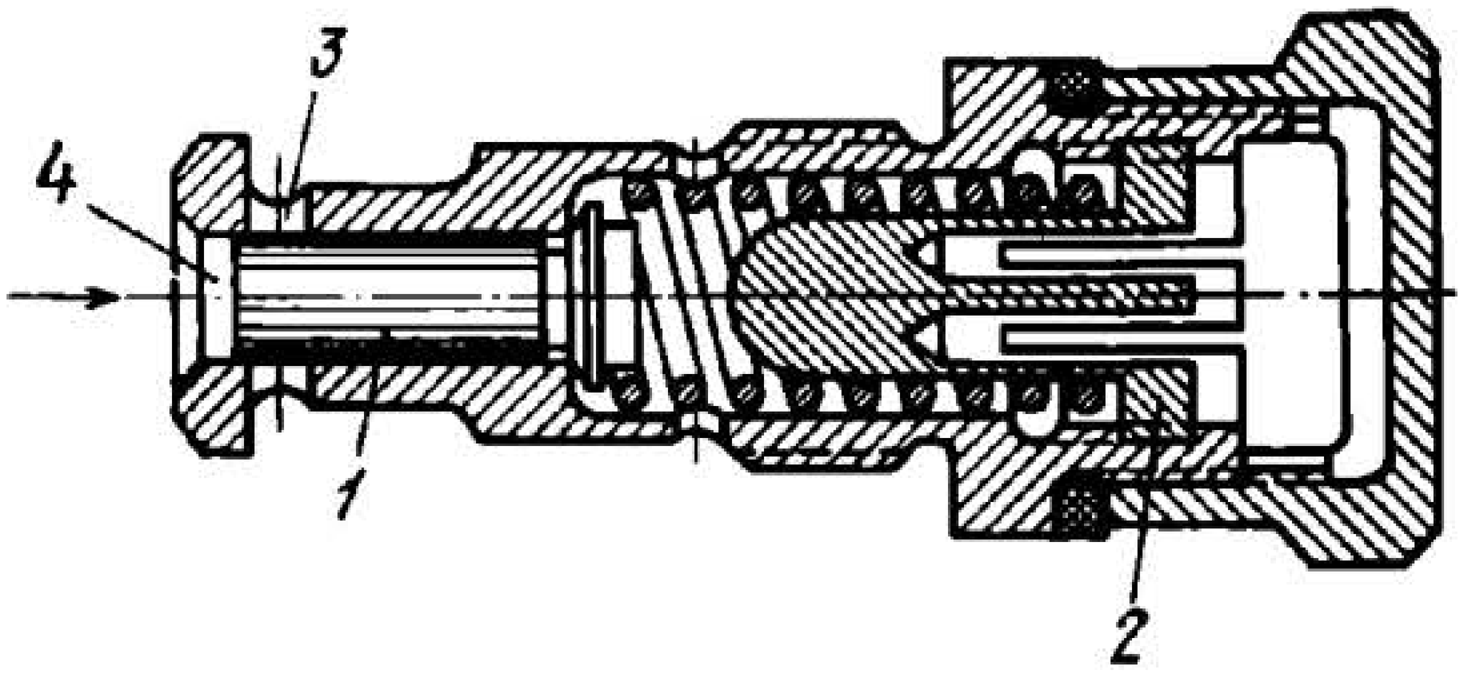
When the pressure of the fluid in port *1* exceeds the preset value, controlled by the setting of the helical spring, sliding valve member *2* is lifted, overcoming the force exerted by the spring and allowing surplus fluid to flow out through port *4* to the receiver. The spring is regulated by screw *3*.

3602	PRESSURE-CONTROL PLUNGER-TYPE VALVE MECHANISM	SHP Va



When the pressure in passage *1* exceeds the preset value, controlled by the setting of the helical spring, hollow plunger *2* is pushed downward, compressing the spring and allowing surplus fluid to flow through slits in the plunger and port *4* into the receiver. The spring is regulated by screw *3*.

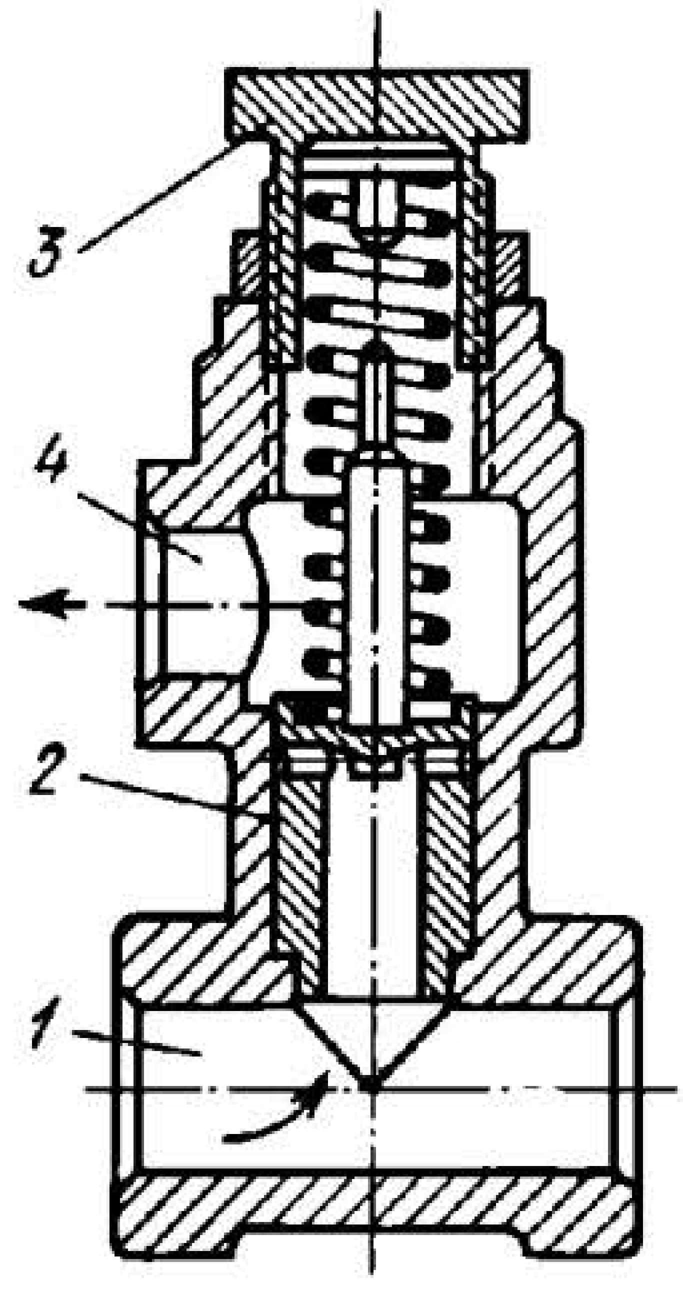
3603	PRESSURE-CONTROL PLUNGER-TYPE VALVE MECHANISM	SHP Va



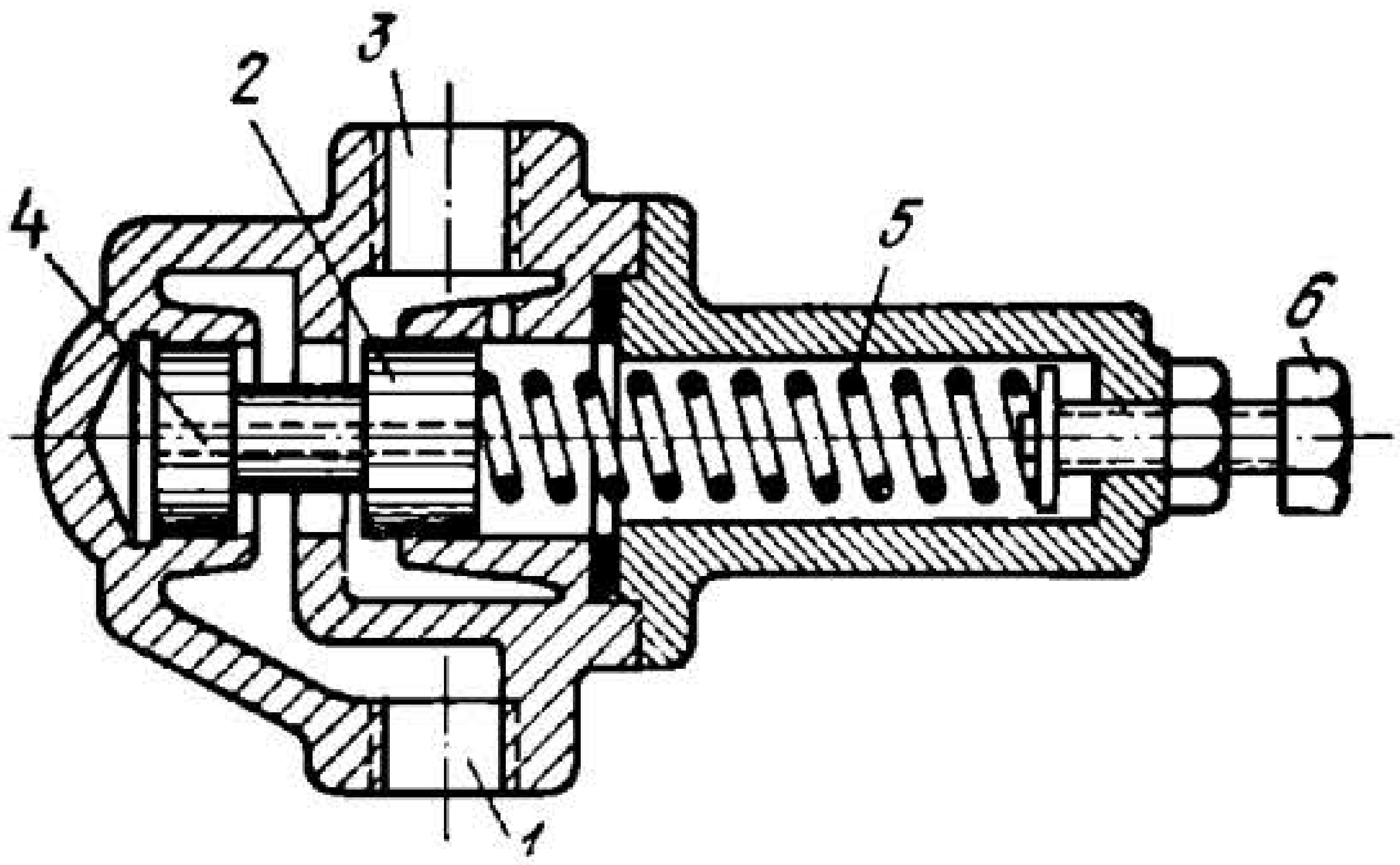
When the pressure of the fluid at port *4* exceeds the preset value, controlled by the setting of the helical spring, plunger *1* is pushed to the right, compressing the spring and allowing the fluid to flow through ports *3* to the receiver. The spring can be regulated by threaded member *2*.

3604	PRESSURE-CONTROL PLUNGER-TYPE VALVE MECHANISM	SHP Va

When the pressure of the fluid in port *1* exceeds the preset value, controlled by the setting of the helical spring, plunger *2* is lifted, compressing the spring and allowing surplus fluid to flow out through holes in the plunger and port *4* into the receiver. The spring is regulated by threaded member *3*.

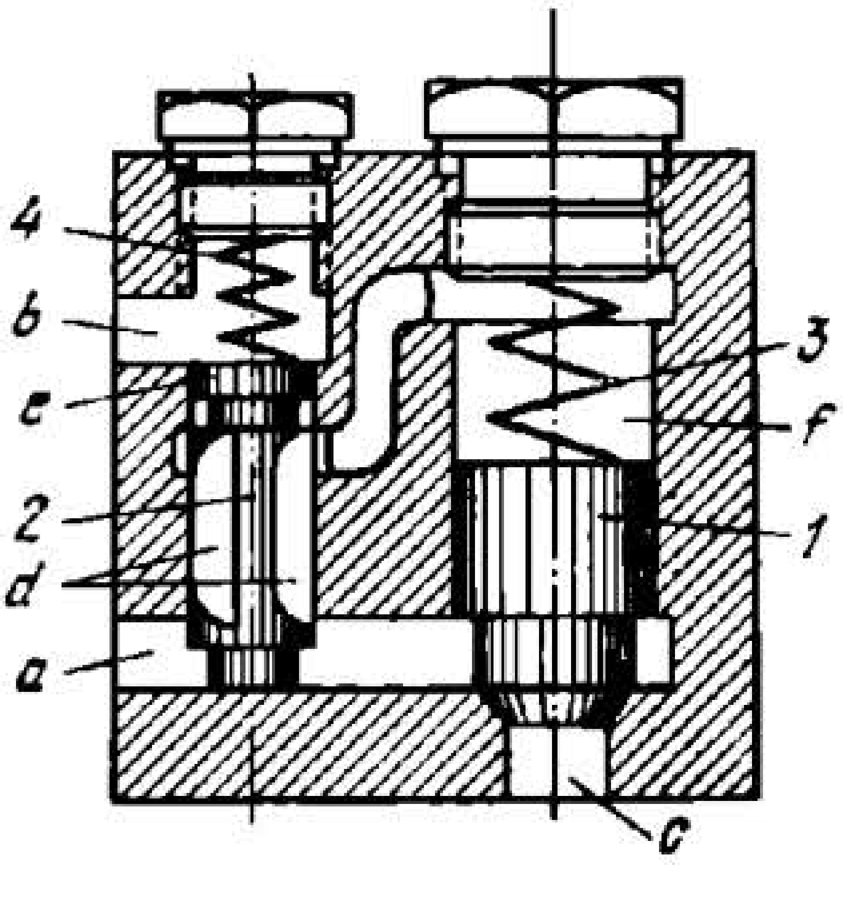


3605	RELIEF VALVE MECHANISM WITH A DAMPING ORIFICE	SHP Va



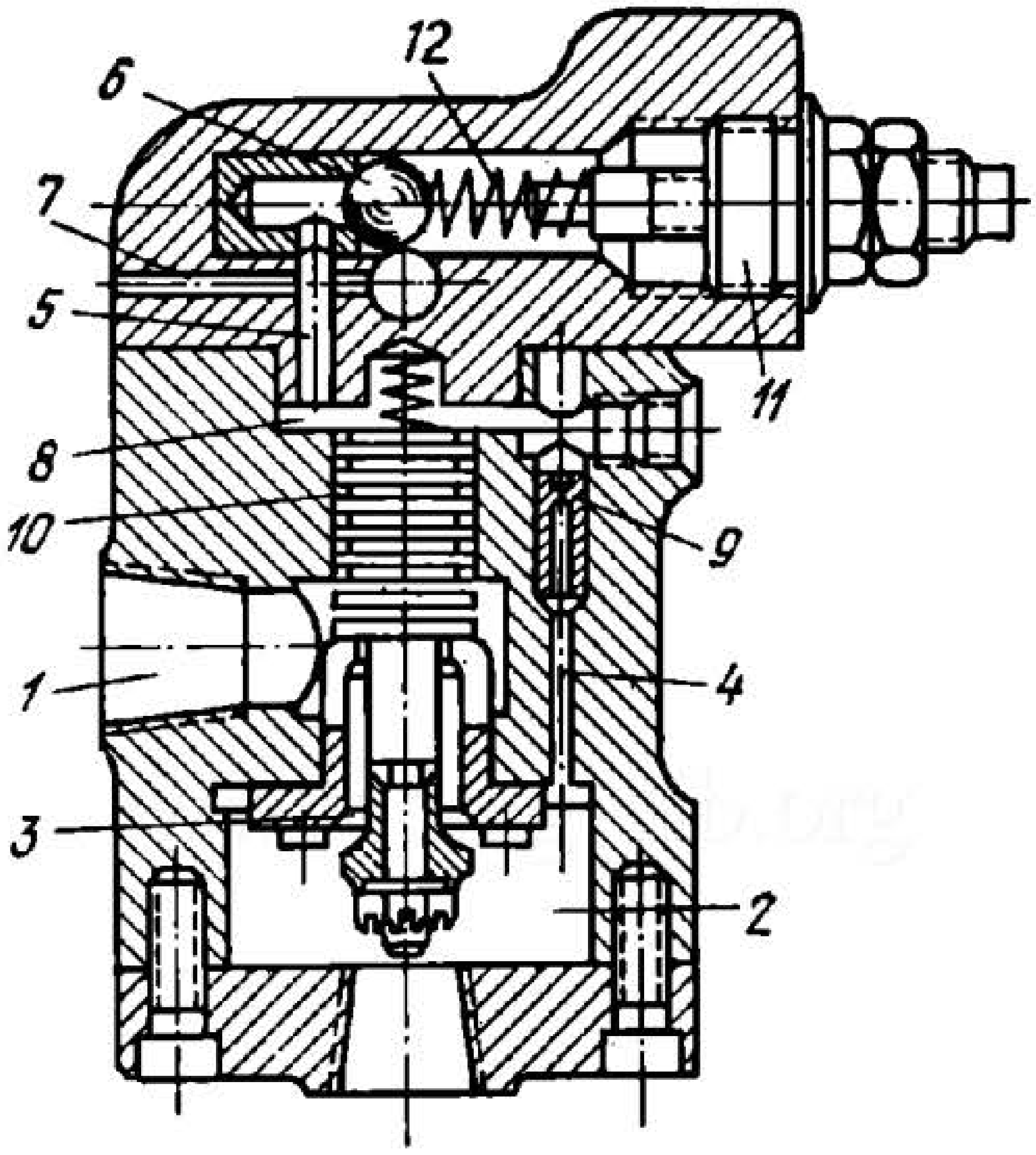
When the pressure of the fluid at port *1* exceeds the preset value, controlled by the setting of helical spring *5*, piston *2* is pushed to the right, allowing the fluid to pass out through port *3*. As the pressure drops, the spring returns piston *2* to its initial position. Spring *5* is regulated by screw *6*. Axial orifice *4* serves to damp the oscillations of piston *2*.

3606	RELIEF VALVE MECHANISM WITH A PILOT	SHP Va



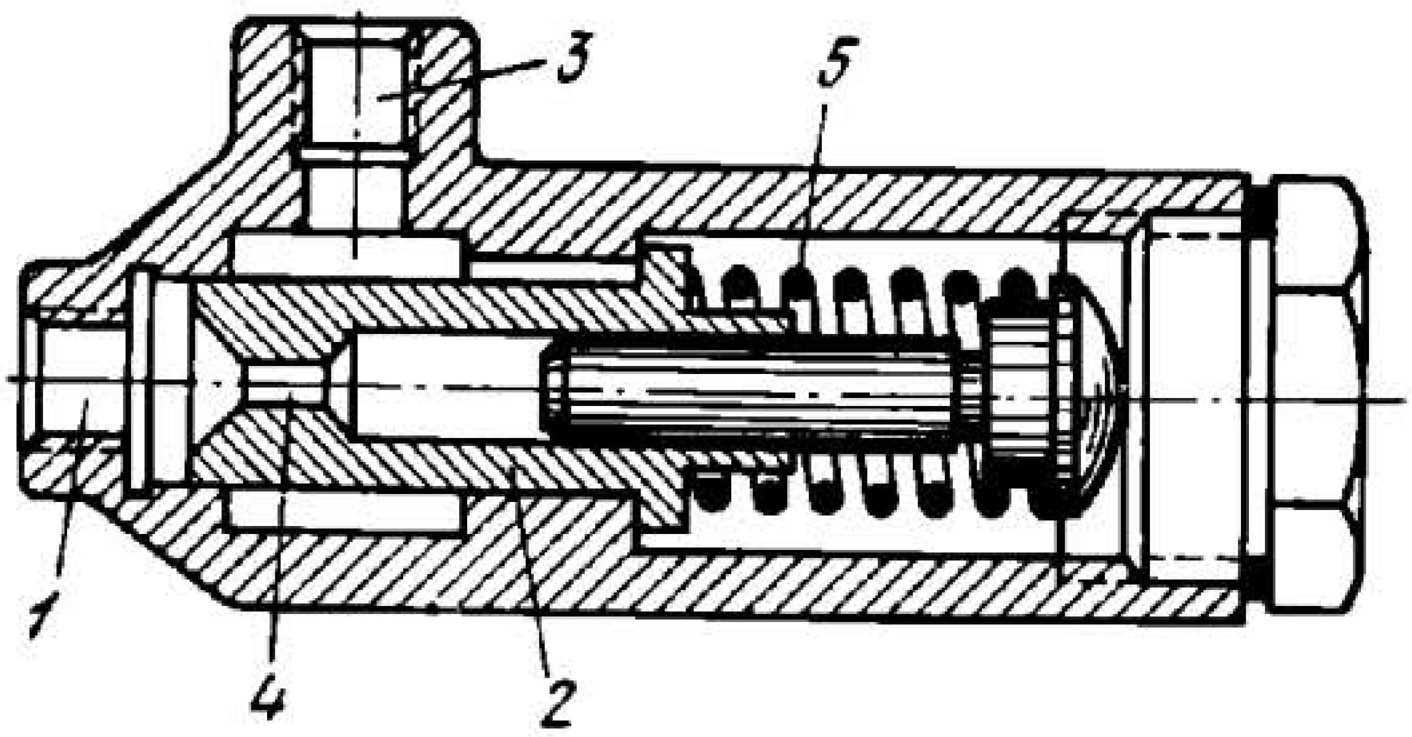
Port *a* is connected to the high-pressure main and ports *b* and *c* to the low-pressure main. When the pressure of the fluid in port *a* is within the preset value, pilot valve spool *2* is held by helical spring *4* in its lower position and through slots *d* it connects chamber *f*, above valve spool *1*, to the high-pressure main. By means of land *e* of pilot valve spool *2*, chamber *f* is disconnected from the low-pressure main. In this position, valve spool *1* is held in its seat by spring *3* and the pressure difference at its ends. When the pressure in port *a* exceeds the preset value, pilot valve spool *2* is lifted, disconnecting chamber *f* from the high-pressure main and connecting it to the low-pressure main. In this position, valve spool *1* is held in its seat only by spring *3*. The pressure in port *a* overcomes the resistance of spring *3*, lifting valve spool *1* and connecting port *a* to the low-pressure main (port *c*) until the pressure drops to within the preset value. Springs *3* and *4* are not adjustable.

3607	PISTON-TYPE PRESSURE-CONTROL VALVE MECHANISM	SHP Va



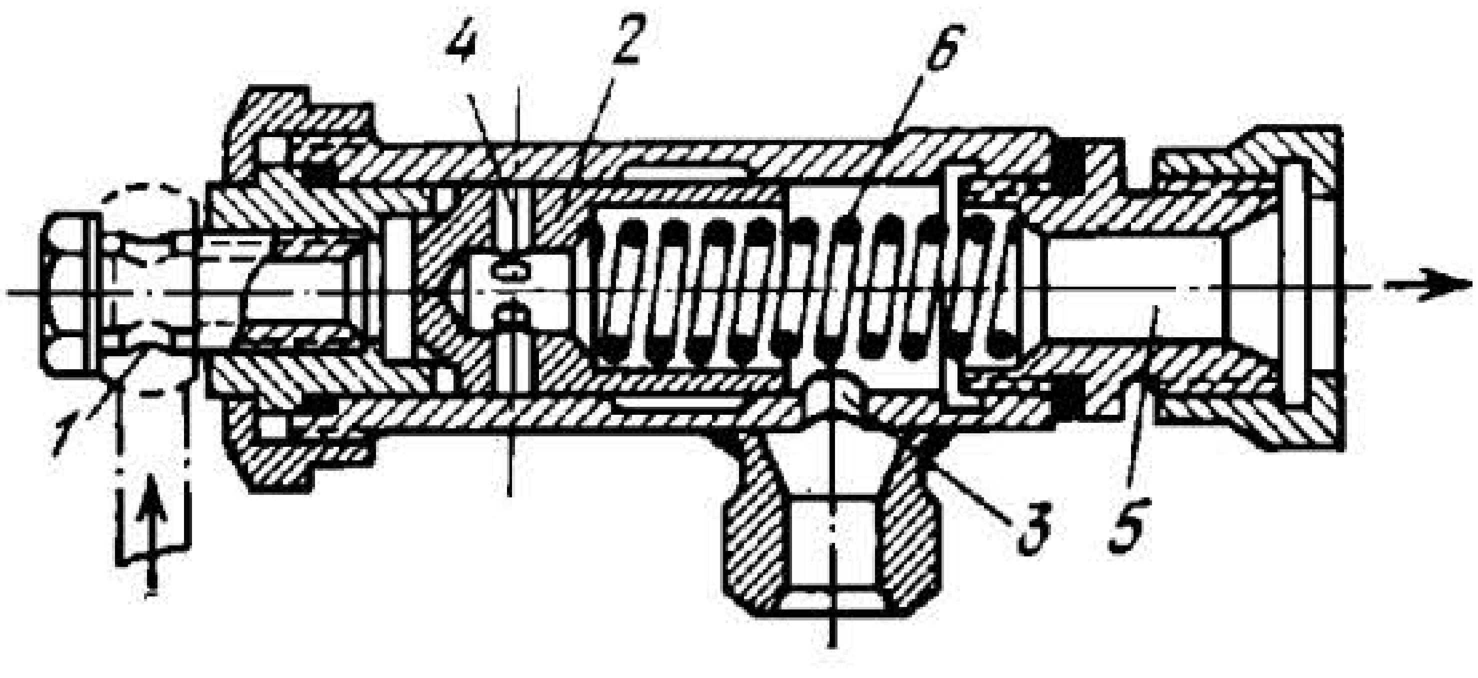
Fluid under pressure flows from port *1* to chamber *2*. Due to the hydraulic loss through slit *3*, the pressure in chamber *2* is lower than in port *1*. Due to the provision of channels *4* and *5*, the pressure established in chamber *8* and behind ball *6* is the same as in chamber *2*. When the pressure increases, ball *6* is pushed off its seat and fluid from chamber *2* flows through channels *4*, *5* and *7* to the tank. Owing to the pressure drop across metering orifice *9*, the pressure in chamber *8* is lower than that in chamber *2*. This forces piston *10* upward and reduces slit *3*, increasing the pressure drop across the slit and thereby reducing the pressure in chamber *2*. The pressure in chamber *2* and the outlet port is regulated by adjusting spring *12* with screw *11*.

3608	PRESSURE-CONTROL VALVE MECHANISM WITH A DAMPING ORIFICE	SHP Va



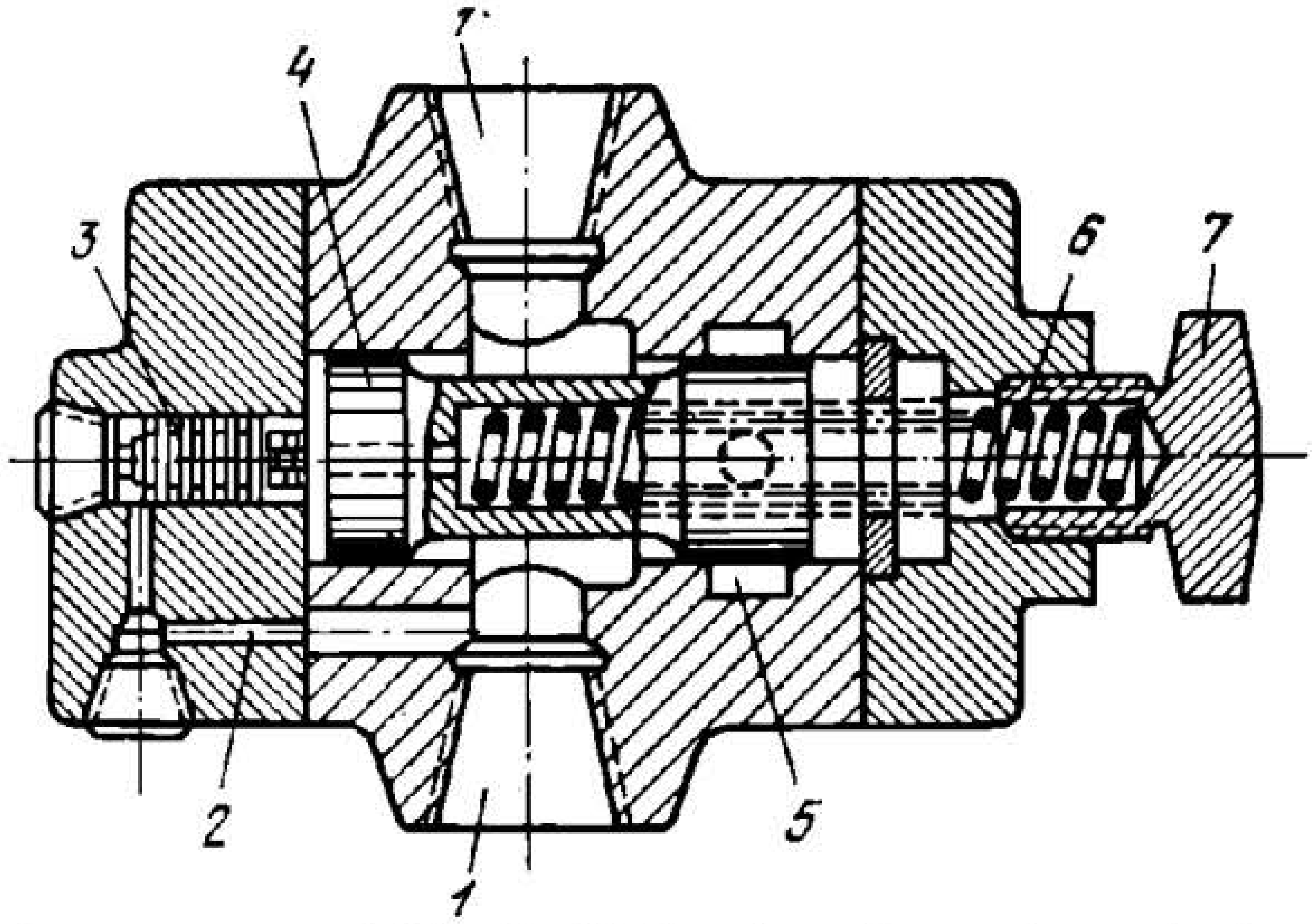
When the pressure of the fluid in port *1* exceeds the preset value, controlled by the force exerted by helical spring *5*, plunger *2* is pushed to the right, allowing the fluid to flow through port *3* to the tank. Axial orifice *4* serves to damp oscillations of plunger *2*, the degree of damping depending upon the size of the orifice.

3609	EMERGENCY-SYSTEM-CONTROLLED SHUTOFF VALVE MECHANISM	SHP Va



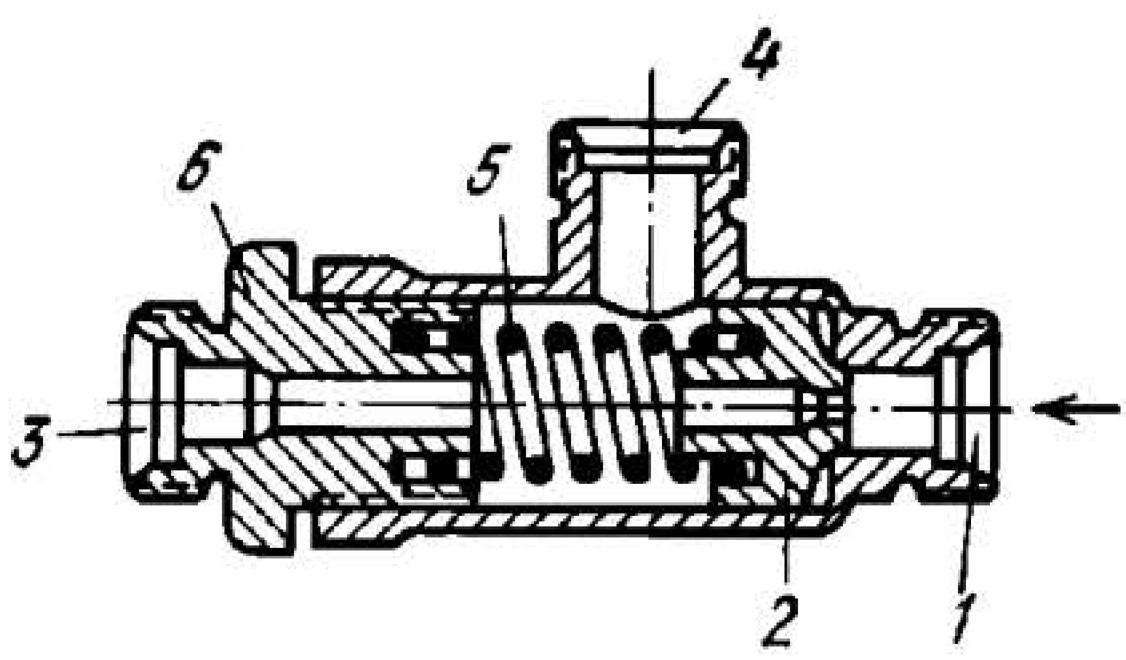
When the emergency system is switched in, fluid flows in through port *1* and pushes plunger *2* to the right, overcoming the resistance of helical spring *6* and shutting off inlet port *3* of the main hydraulic system. The fluid flows through a recess in the valve body and holes *4* to port *5*.

3610	BALANCED-PISTON PRESSURE-CONTROL VALVE MECHANISM	SHP Va



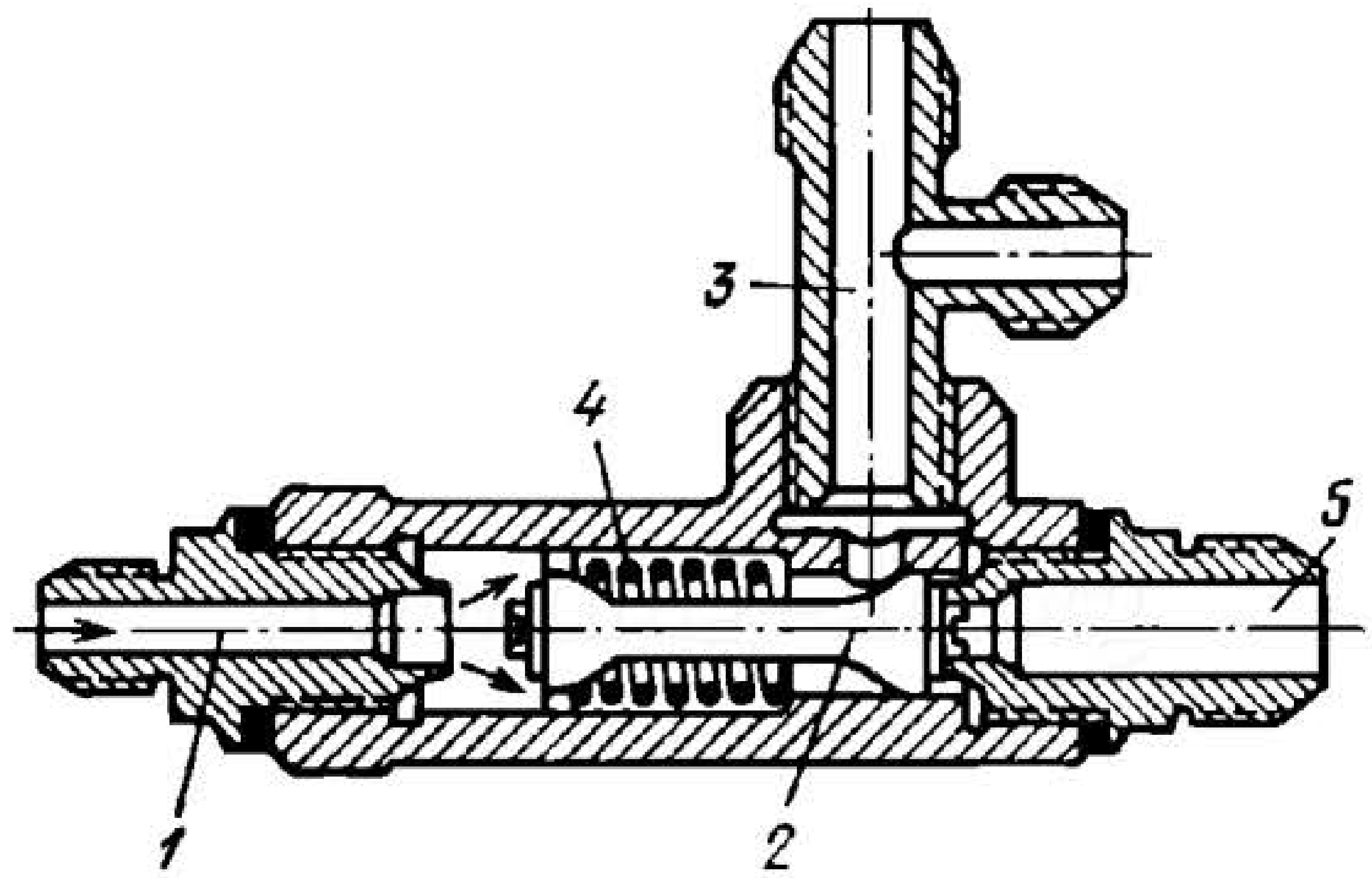
When the pressure of the fluid flowing through ports *1* exceeds the preset value, controlled by the setting of helical spring *6*, fluid flowing through channel *2* pushes plunger *3* and spool *4* to the right, opening chamber *5* from which fluid drains to the tank. Narrow channel *2* operates as a damping orifice for damping the oscillations of the valve spool. When the pressure drops, spring *6*, regulated by threaded member *7*, pushes spool *4* to the left, closing chamber *5*.

3611	EMERGENCY-SYSTEM-CONTROLLED SHUTOFF VALVE MECHANISM	SHP Va



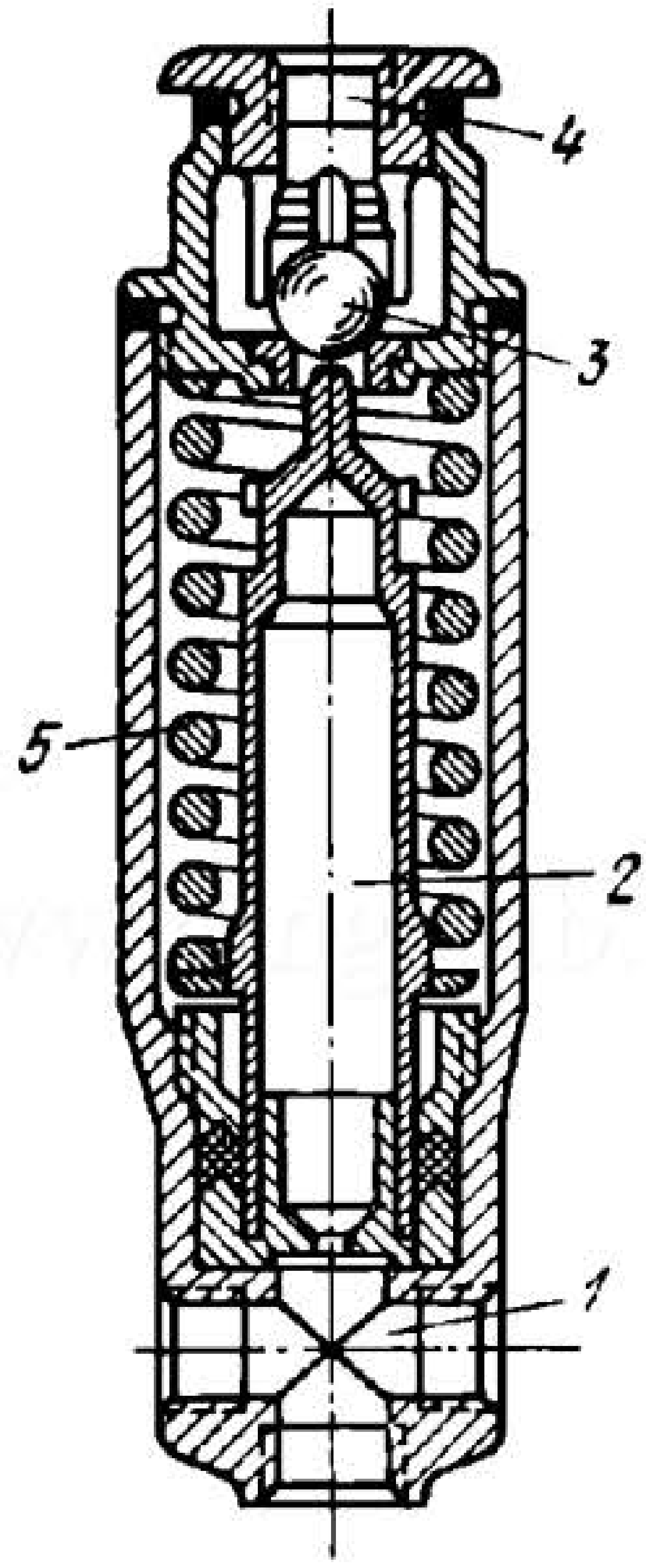
When the emergency system is switched in, fluid flows in through port *1* and pushes plunger *2* to the left, overcoming the resistance of helical spring *5* and shutting off inlet port *4* of the main hydraulic system. The fluid then flows through an axial hole in plunger *2* and out through port *3*. Spring *5* is adjusted by threaded member *6*.

EMERGENCY-SYSTEM-CONTROLLED AIR SHUTOFF VALVE MECHANISM



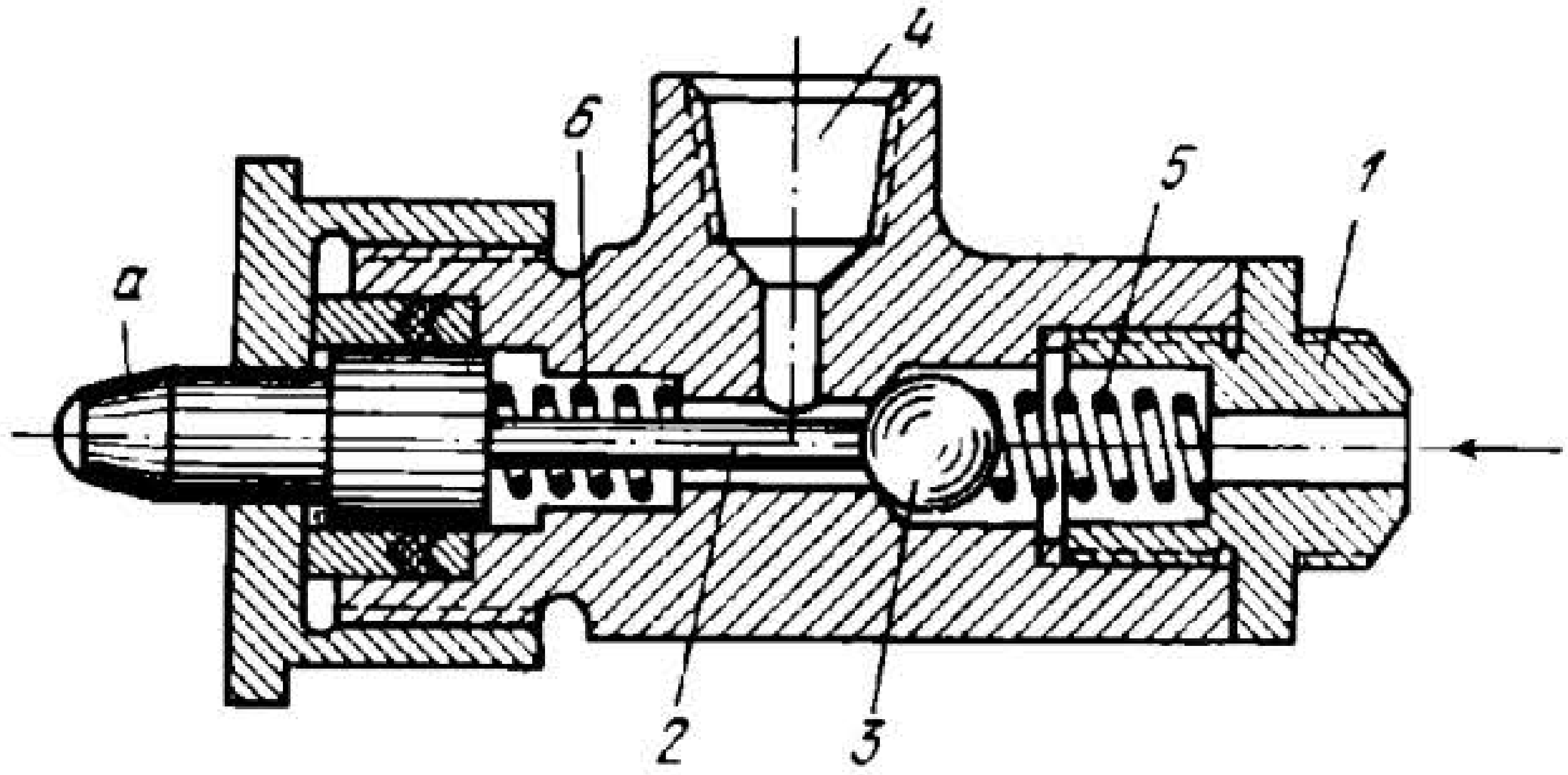
When the emergency system is switched in, air under pressure is delivered through connection *1*, pushing valve spool *2* to the right, overcoming the resistance of helical spring *4* and shutting off inlet port *5* of the main pneumatic system. This air flows through slots in spool *2* and out through port *3*.

RELIEF VALVE MECHANISM



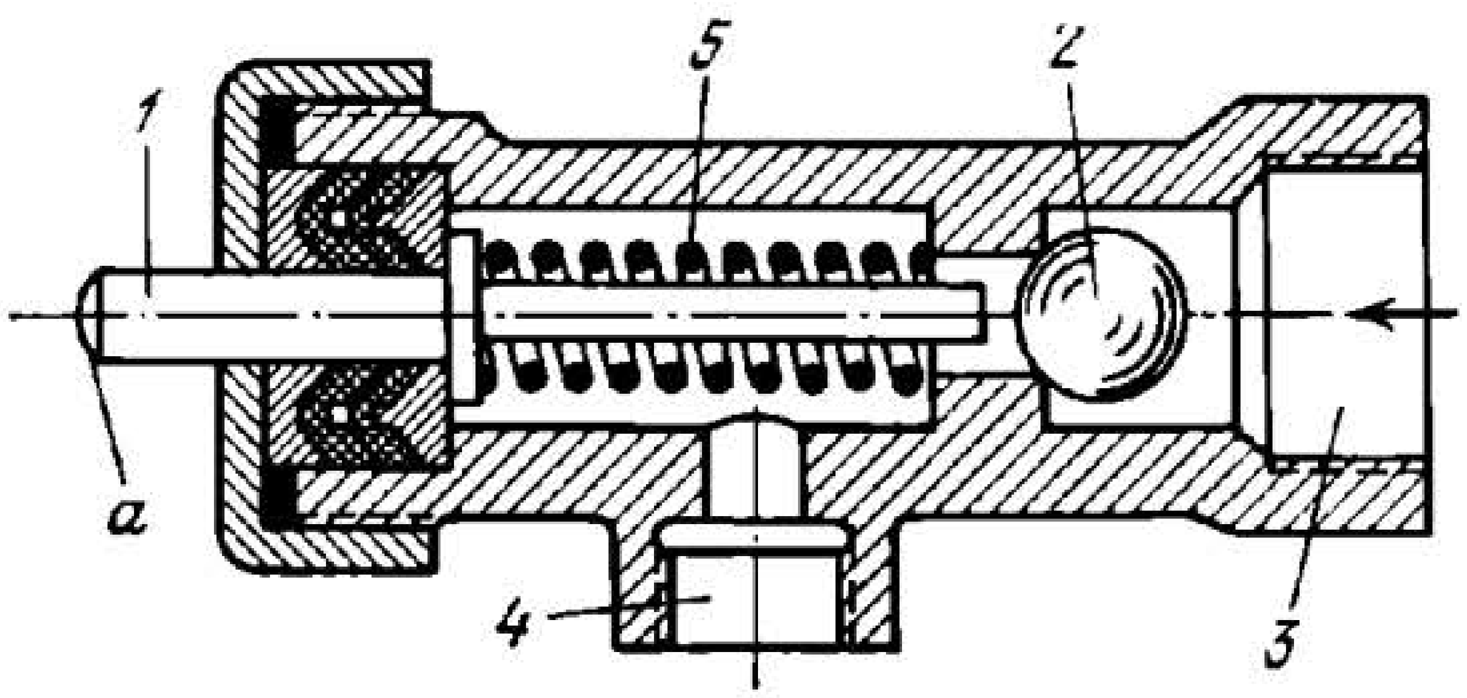
When the pressure of the fluid flowing through ports *1* exceeds the preset value, controlled by the force exerted by helical spring *5*, plunger *2* is lifted and it opens ball valve *3* allowing fluid to flow out freely through port *4*.

3614	CAM-OPERATED UNLOADING VALVE MECHANISM	SHP Va



The valve is connected to the high-pressure main by connection *1*. When it is necessary to reduce the pressure in the main, head *a* is depressed, overcoming the resistance of helical springs *6* and *5* and pushing rod *2* and ball *3* to the right. This connects the high-pressure main to a relief valve. The latter is connected to port *4*.

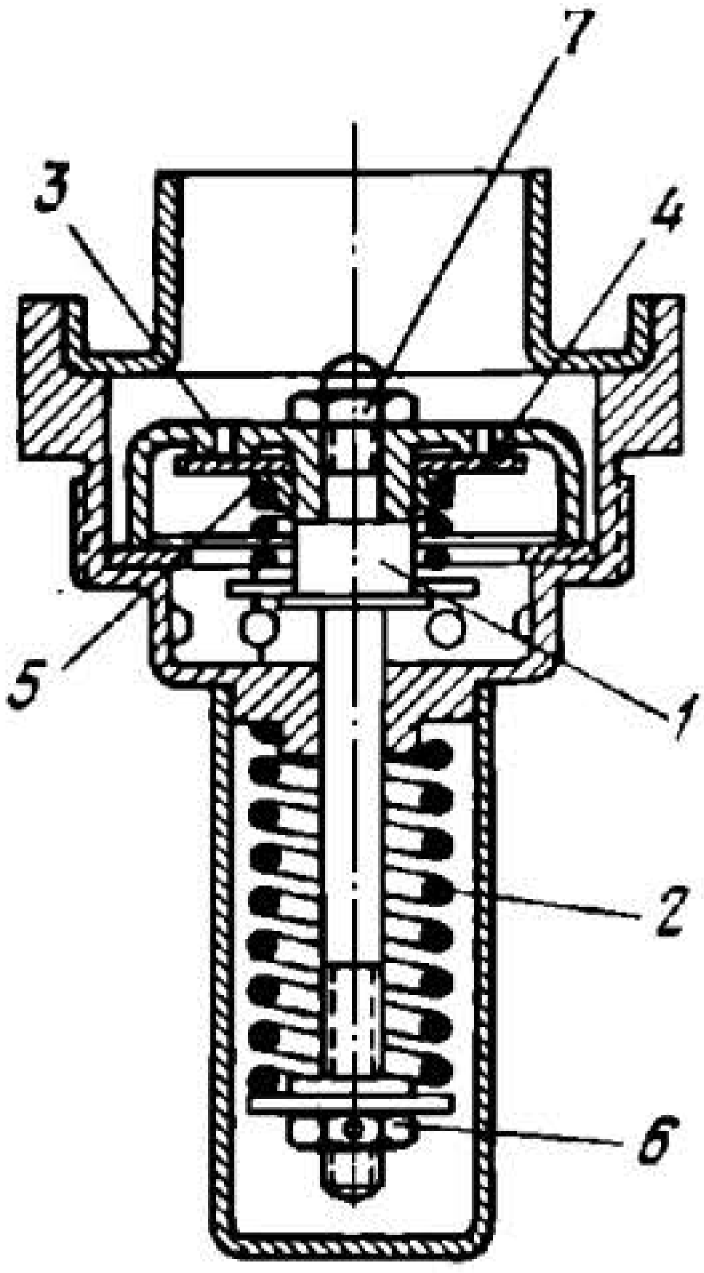
3615	CAM-OPERATED NORMALLY CLOSED SHUTOFF VALVE MECHANISM	SHP Va



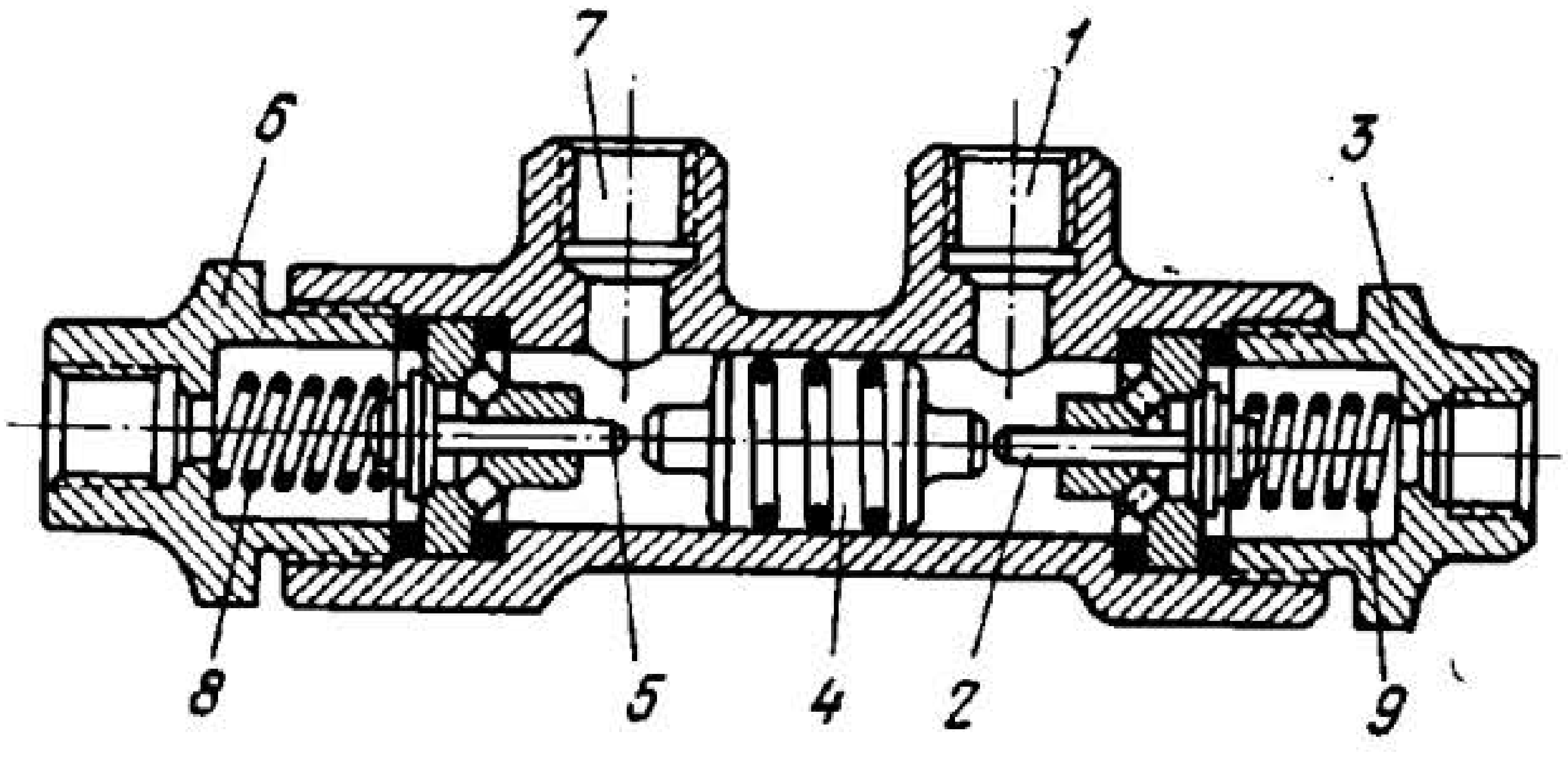
When head *a* is depressed, stem *1* overcomes the resistance of helical spring *5*, pushing ball *2* to the right and allowing the flow of fluid from port *3* to port *4*.

3616	CONSTANT-PRESSURE-DROP BLEED-OFF VALVE MECHANISM	SHP Va

When the air pressure in the chamber under valve member *1* exceeds a preset value, member *1* is lifted, compressing helical spring *2* and connecting the high-pressure chamber to the atmosphere. When the pressure in the system is below atmospheric, air flows through holes *3*, acting on disk *4* and compressing spring *5*, and enters the system, raising its pressure. Springs *2* and *5* are regulated by nuts *6* and *7*.

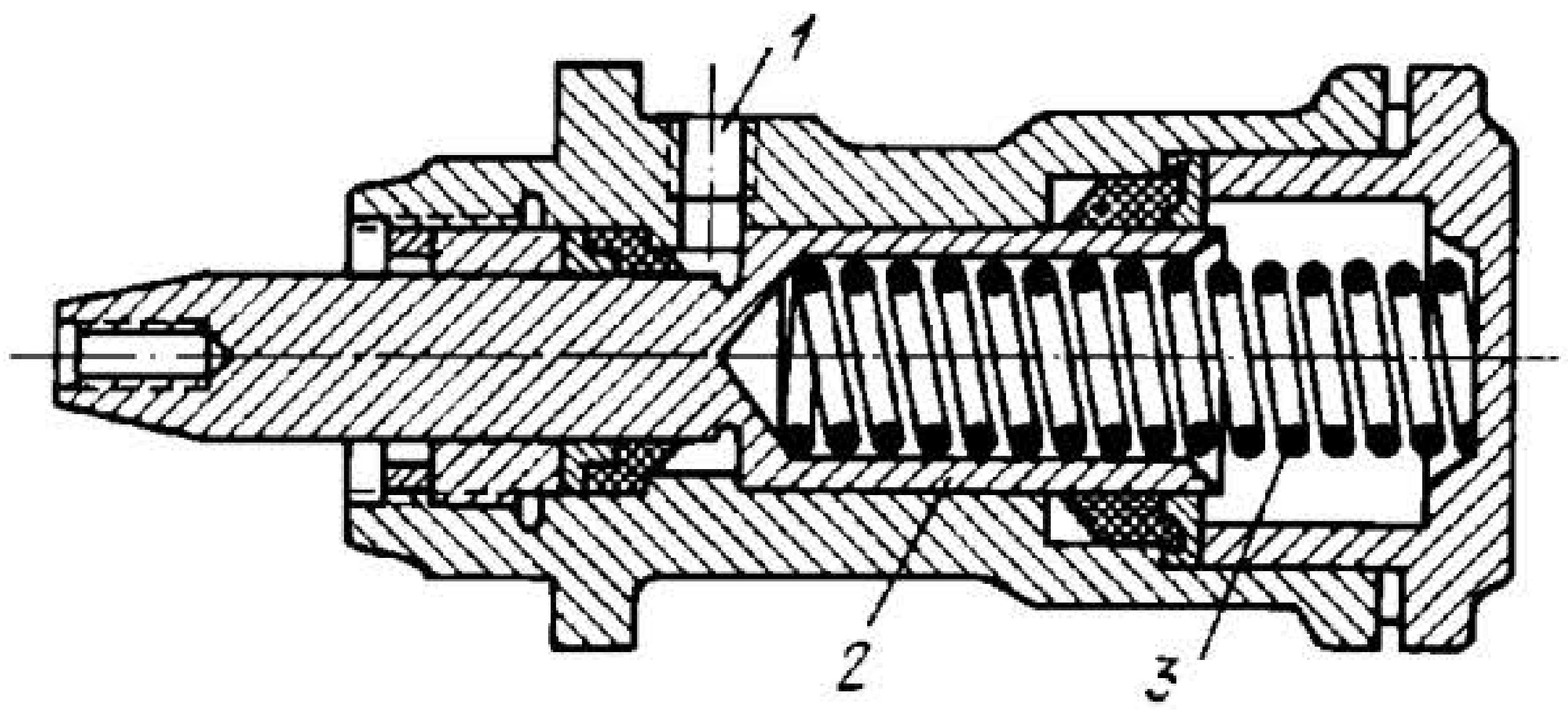


3617	DOUBLE INTERLOCKING DIRECTIONAL VALVE MECHANISM	SHP Va



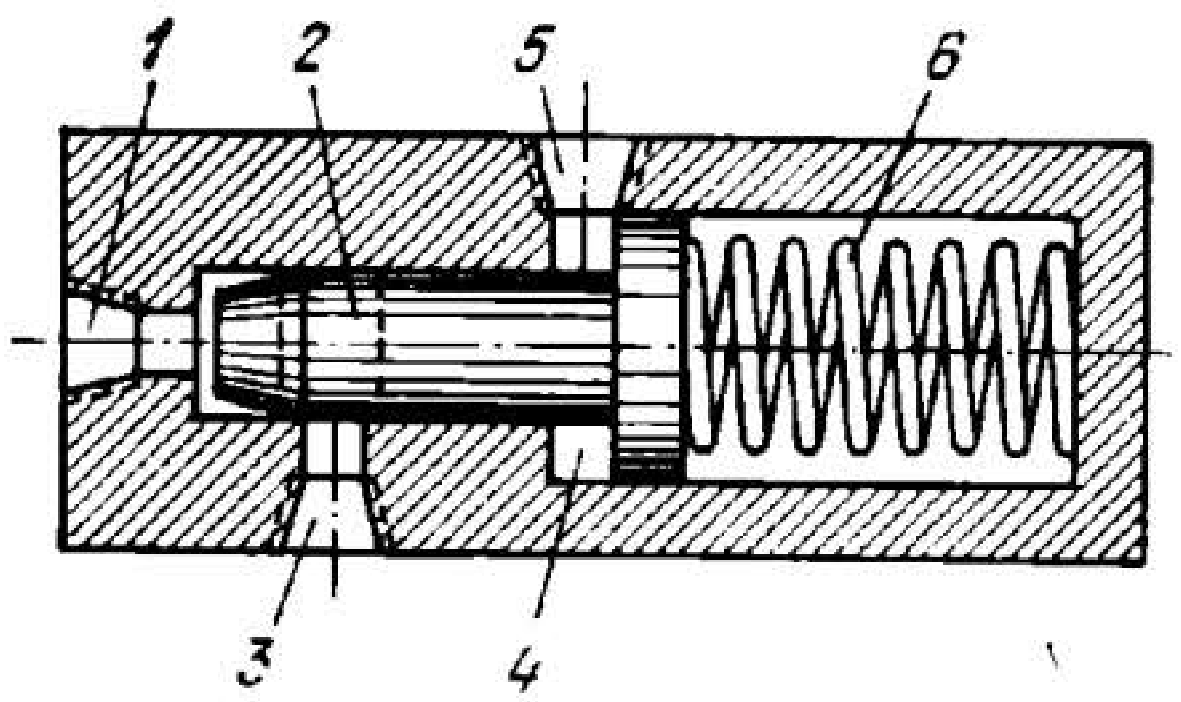
Fluid delivered by the pump enters through port *1* and shifts valve member *2* to the right, compressing spring *9* and admitting fluid through connection *3* to the power cylinder and pushing floating spool *4* to the left. With its left end, spool *4* opens valve member *5*, compressing spring *8* and discharging fluid from the other end of the power cylinder through connection *6* and port *7* to the tank.

3618	REMOTE-CONTROL OPERATING VALVE MECHANISM	SHP Va



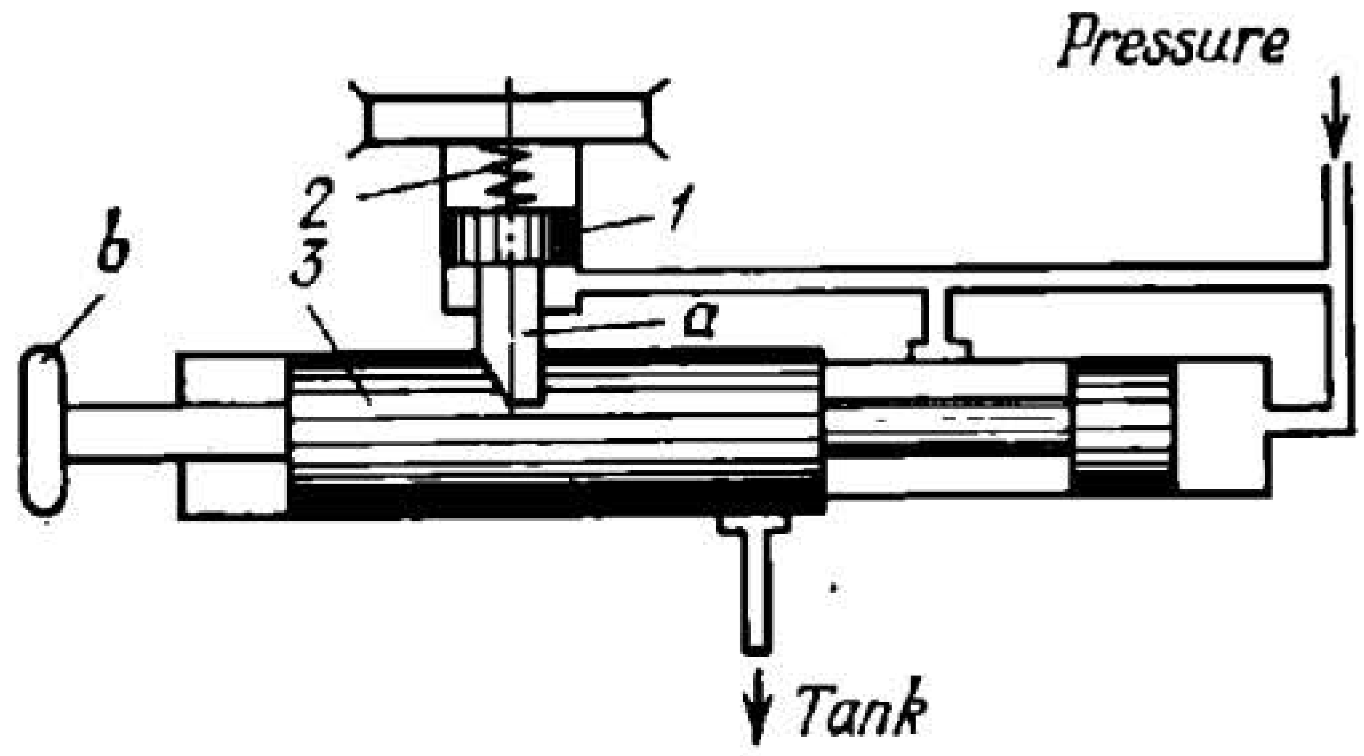
When the pilot pressure at port *1* reaches a preset value, controlled by the force exerted by helical spring *3*, plunger *2* is pushed to the right, shifting the operating member. Spring *3* returns plunger *2* to its initial position when the pressure drops.

3619	BY-PASS VALVE MECHANISM	SHP Va



When the pressure of the fluid in port *1* exceeds the preset value, piston *2* is pushed to the right, overcoming the resistance of spring *6* and allowing the fluid to flow through port *3* to the tank. To improve the sensitivity of the valve, allowing it to operate at a lower pressure, the pressure is raised in chamber *4* through port *5*. The higher the pressure in chamber *4*, the less the pressure required in port *1* to shift the piston.

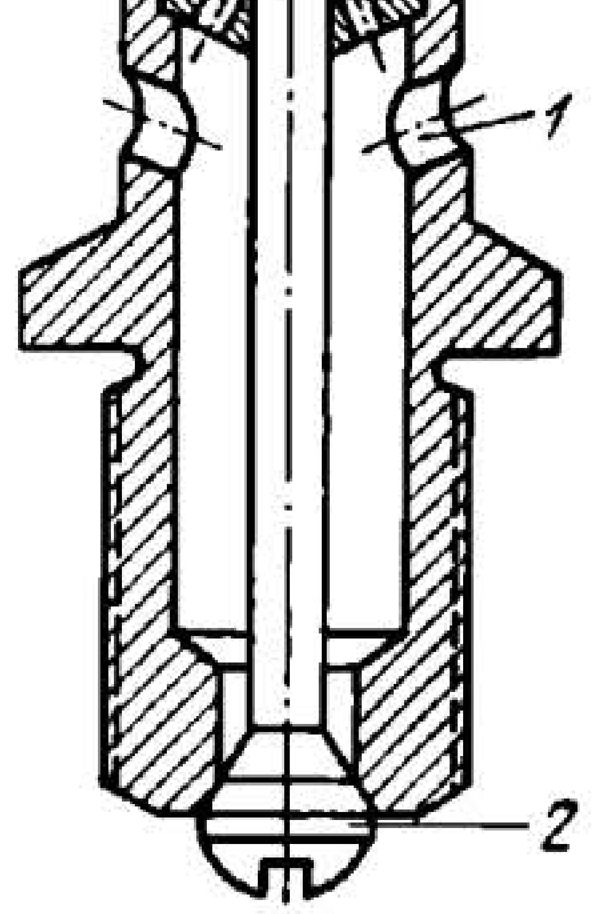
3620	UNLOADING VALVE MECHANISM WITH A LOCKING MEMBER	SHP Va



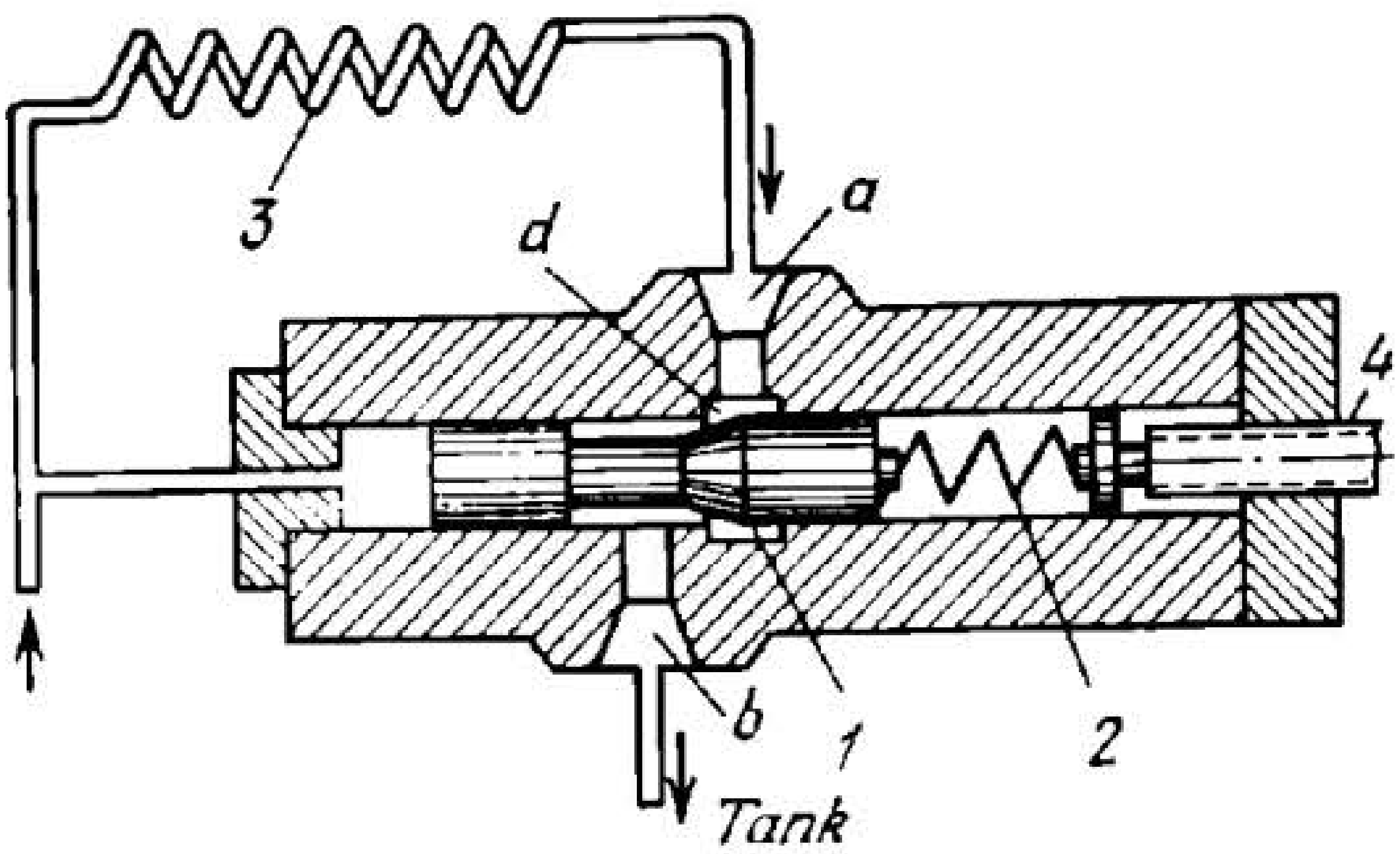
When the pressure in the system exceeds a preset value, controlled by the force exerted by helical spring *2*, piston *1* is lifted, compressing spring *2*. This disengages wedge-shaped pin *a* from piston *3*, connecting the system to the tank so that its pressure drops. Piston *3* is returned to its initial position by depressing knob *b*.

3621	STARTING VALVE MECHANISM	SHP Va

When the pressure of the air entering through ports *1* exceeds a preset value, controlled by the setting of helical spring *3*, valve *2* is pushed downward and air is admitted into the system. Spring *3*, regulated by threaded member *4*, returns valve *2* to its initial position.

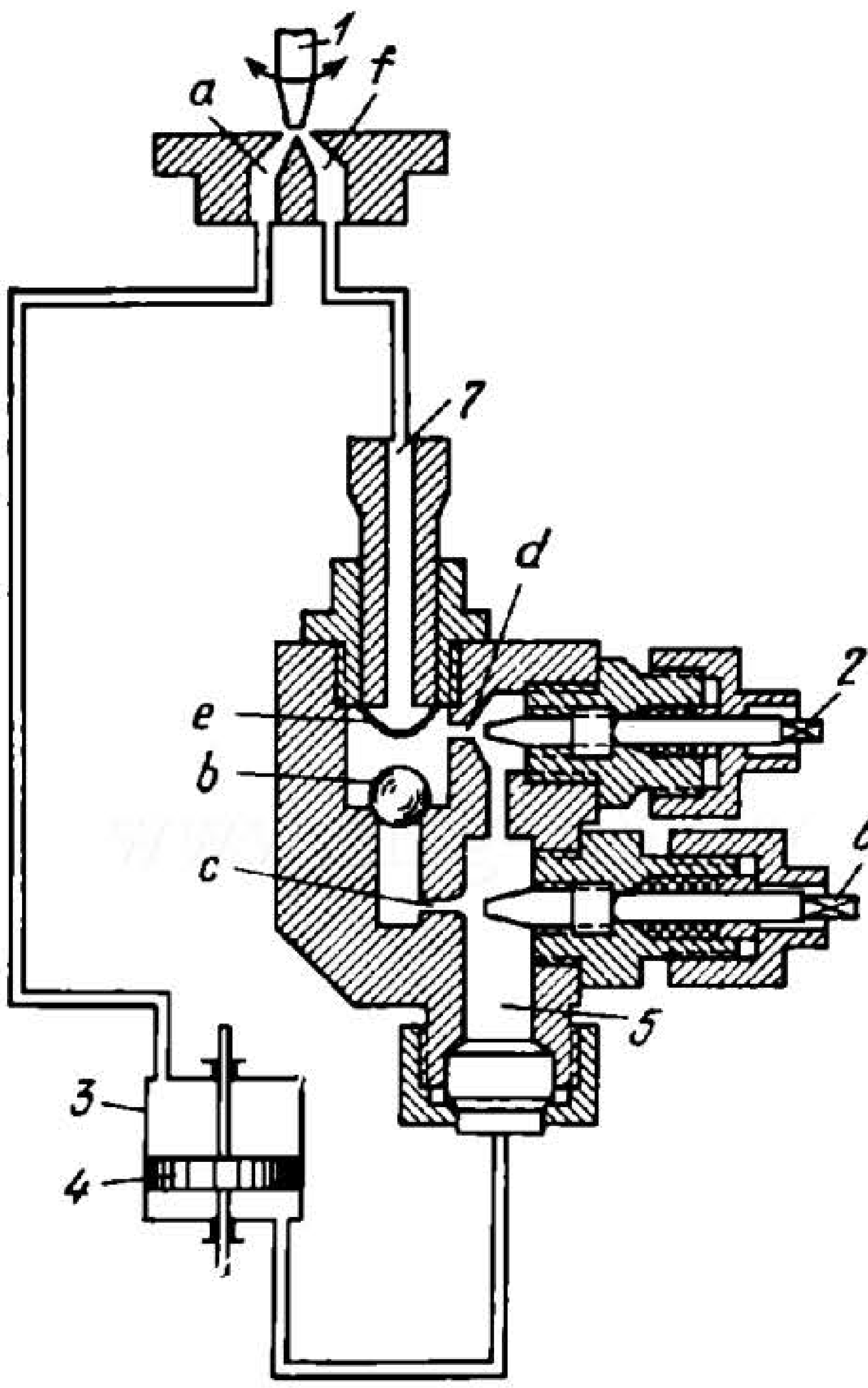


3622	PRESSURE-CONTROL VALVE MECHANISM WITH A COILED TUBE	SHP Va



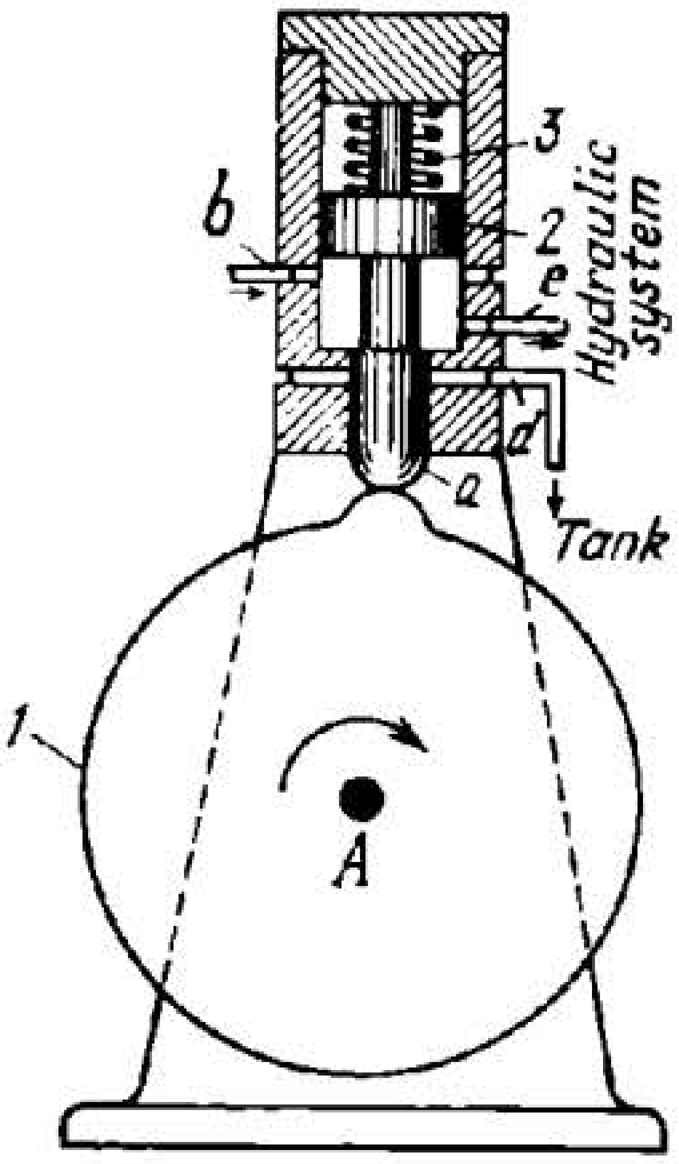
When the fluid pressure in the system exceeds a preset value, controlled by the setting of helical spring *2*, valve spool *1* is pushed to the right, compressing spring *2*. A part of the fluid of the system flows through port *a*, annular clearance *d* and port *b* to the tank. Coiled tube *3* prevents oscillation of spool *1* upon sharp changes in the fluid pressure in the system. Spring *2* is regulated by screw *4*.

3623	JET VALVE FLOW-CONTROL MECHANISM	SHP Va



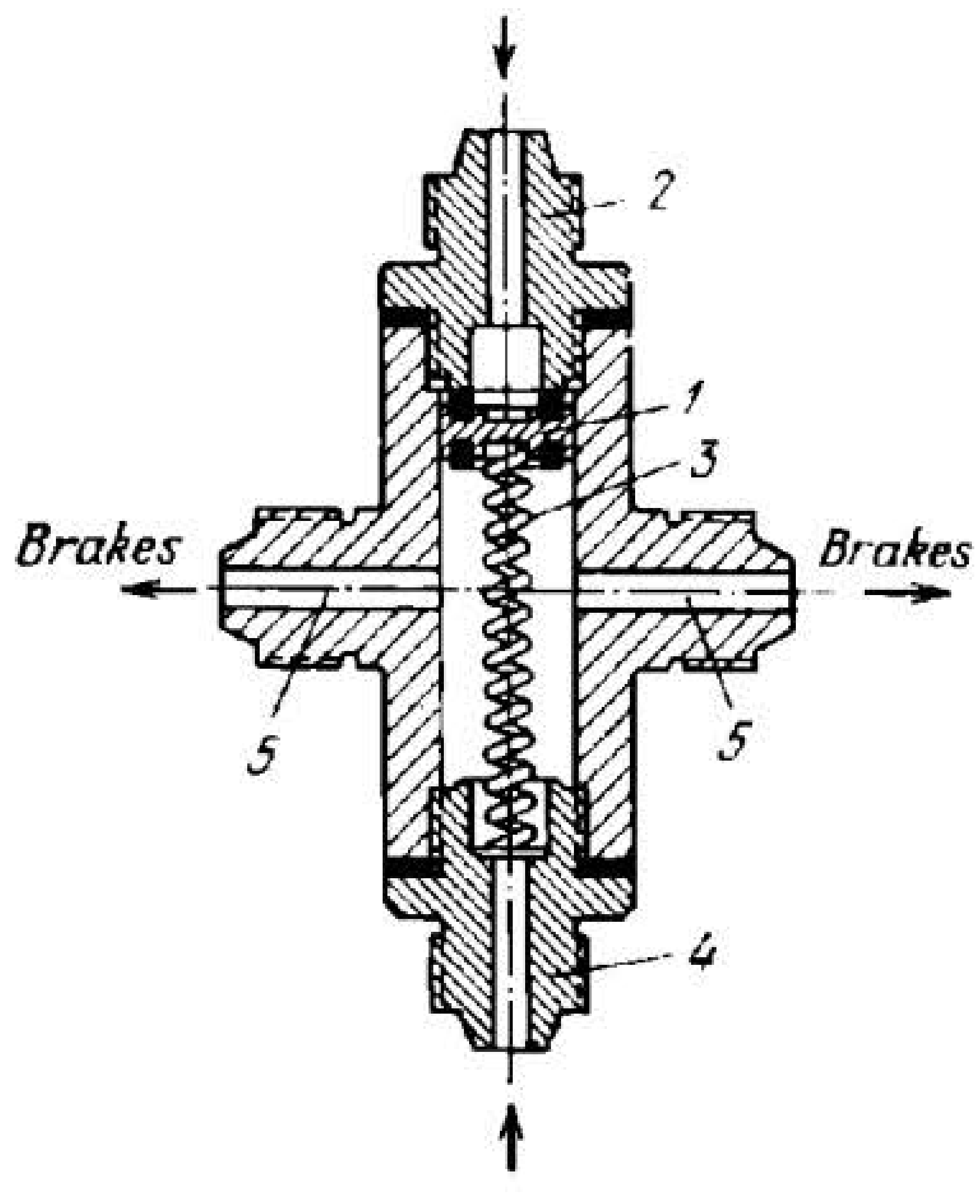
When jet valve nozzle *1* is diverted to the left, the fluid delivered to the nozzle flows through left channel *a* to the upper end of servomotor *3*, shifting piston *4* downward. Fluid forced out of the lower end of servomotor *3* flows through passage *5* and lifts ball *b* (up to shackle *e*). This opens two orifices, *c* and *d*, for the fluid. When jet valve nozzle *1* is diverted to the right, the fluid flows through right channel *f* and connection *7*, pressing ball *b* into its seat. In this case the fluid passes through orifice *d* to the lower end of servomotor *3*, shifting piston *4* upward comparatively slowly. The volume of flow through orifices *c* and *d* can be regulated with needle members *6* and *2*.

3624	CAM-OPERATED DIRECTIONAL VALVE MECHANISM	SHP Va



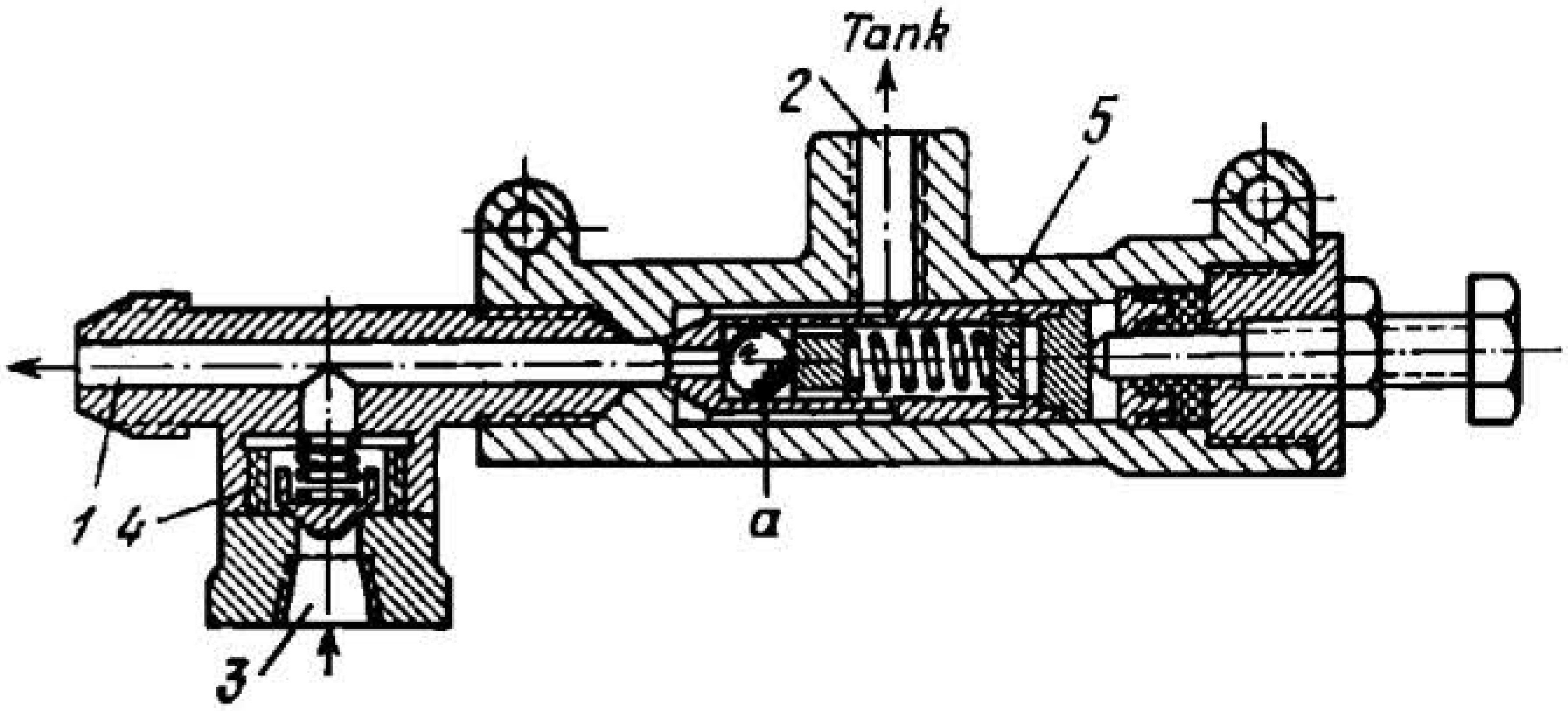
As cam *1* rotates about fixed axis *A*, head *a*, attached to piston *2* of the valve, is lifted, overcoming the resistance of helical spring *3* and closing port *d*, which is connected to the tank. At this, fluid under high pressure, delivered to port *b*, flows into the hydraulic system through port *e*.

3625	EMERGENCY AIRCRAFT WHEEL BRAKE CONTROL VALVE MECHANISM	SHP Va



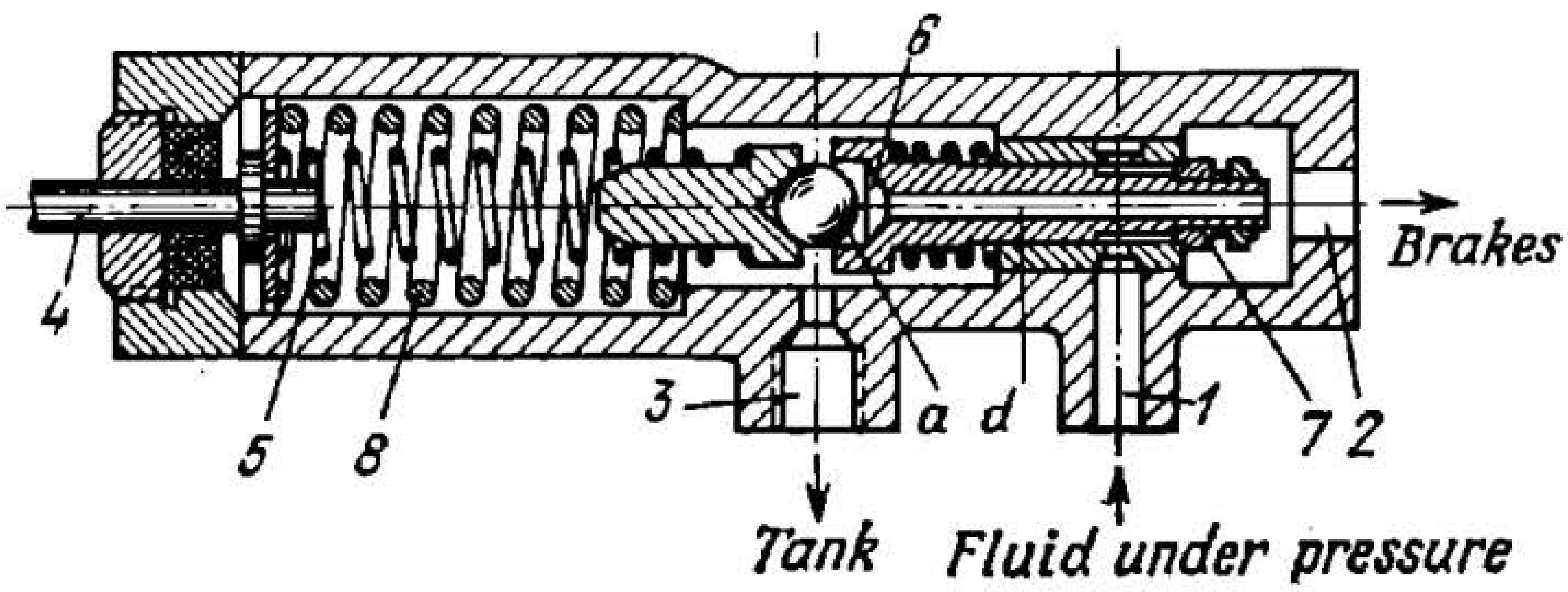
In normal braking action, floating piston *1* is held against the seat in connection *2* by helical spring *3* and by the pressure of the fluid delivered through connection *4* from the main hydraulic system of the aircraft to the brakes through ports *5*. When the emergency system is switched in, compressed air, entering through the channel of connection *2*, pushes away piston *1*, compressing spring *3* and closing off the main line. Compressed air flows through ports *5* into the brake cylinders, thereby braking the aircraft.

3626	RELIEF AND DRAIN VALVE MECHANISM FOR AN AIRCRAFT ACCUMULATOR	SHP Va



Port *1* of the valve is connected to the accumulator, port *2* to the tank, and port *3* to the main hydraulic system of the aircraft. Nonreturn valve *4* admits fluid under pressure from the main hydraulic system to the accumulator and prevents flow in the reverse direction. Thus, if the main hydraulic system gets out of order, there is always fluid available under pressure in the accumulator to operate the brakes. When the pressure in the accumulator exceeds a preset value, ball *a* is pushed to the right off its seat, compressing the helical spring and connecting the accumulator to port *2*, which leads to the tank. The maximum pressure in the accumulator is set by means of the spring backing up ball *a*. The force exerted by the spring is regulated by threaded plug *5*.

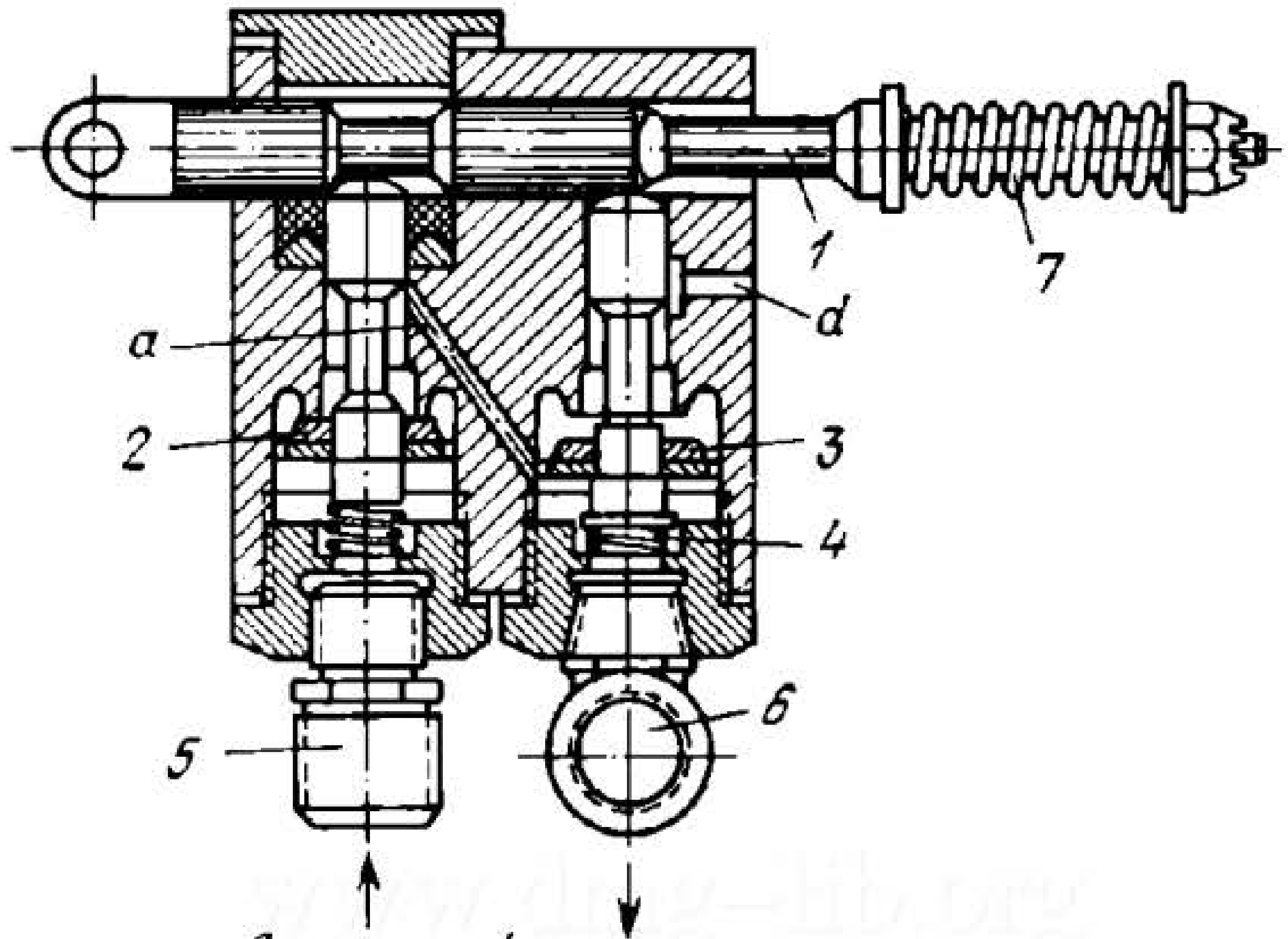
BRAKE CONTROL VALVE MECHANISM



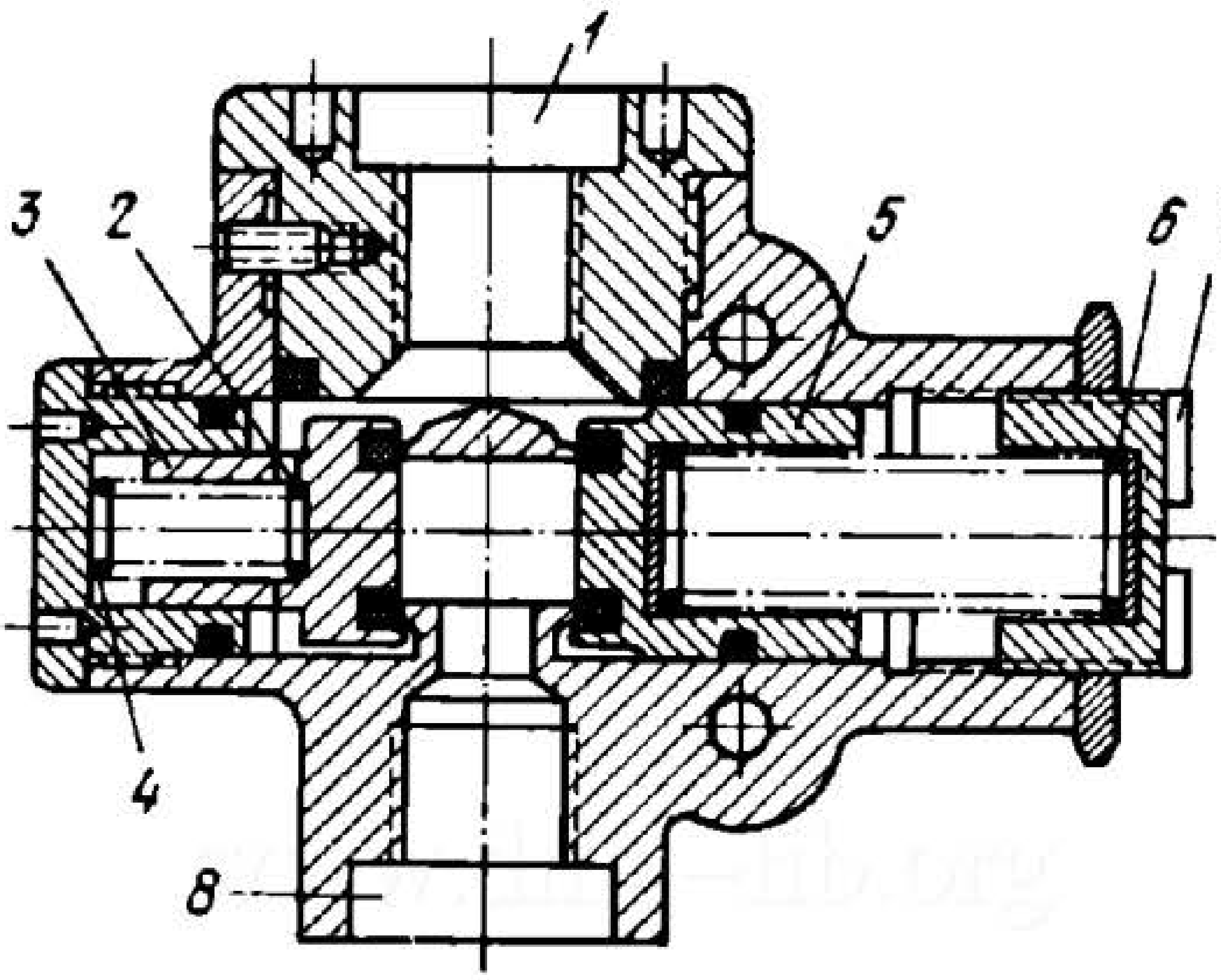
Fluid under pressure from the accumulator is delivered to the valve through port *1*. Port *2* is connected to the brakes, and port *3*, to the tank. When the brake pedal is depressed, stem *4* actuates spring *5* which presses ball *a* into its seat in piston *6*, closing off channel *d* and opening valve member 7. This connects ports *1* and *2*, and fluid under pressure is delivered to the brake cylinders. In releasing the brakes, when the force applied to stem *4* is reduced, the pressure of the fluid in the brake line, acting on ball *a* through axial channel *d*, pushes the ball to the left and connects the brake cylinders to the drain through port *3*.

Spring *8* returns stem *4* to its initial position.

EMERGENCY AIRCRAFT PNEUMATIC WHEEL BRAKE VALVE MECHANISM

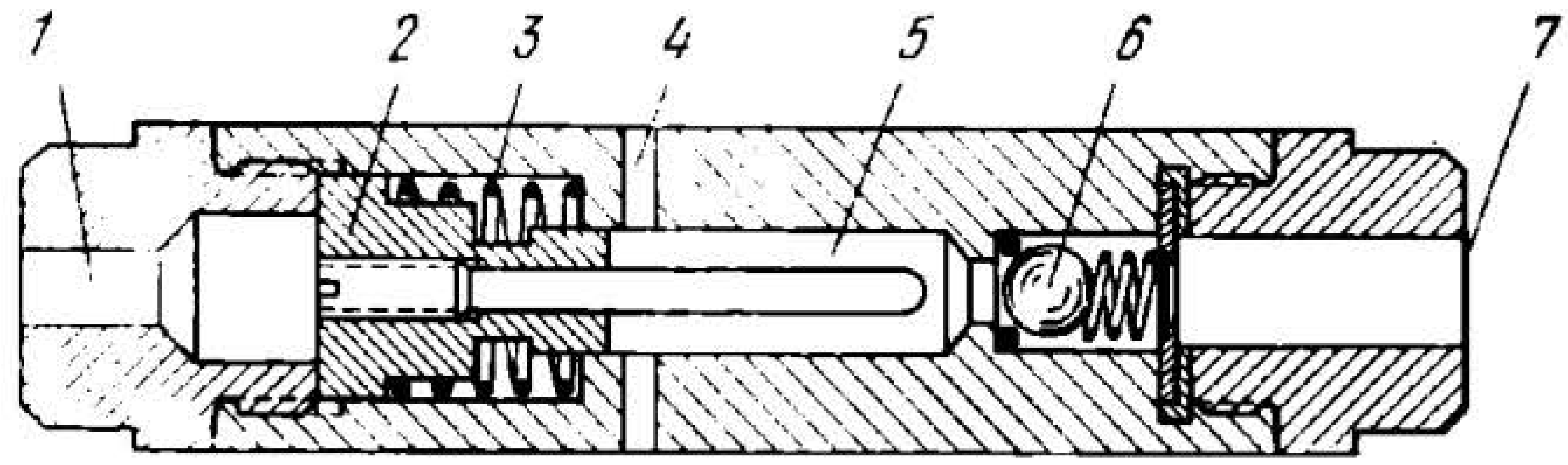


When the emergency system is switched in, cam rod *1*, linked to this system, is shifted to the left from its middle position, contacting the rounded heads of plungers *2* and *3* and pushing the former downward and allowing the latter to be shifted upward by spring *4*. This opens admission valve *2* and closes drain valve *3*. Compressed air from the tank is admitted through connection *5*, channel *a* and connection *6* to the brake cylinders, braking the wheels. When the brake lever is released, spring 7 returns cam rod *1* to its middle position in which both of the valves are closed, holding the brakes in the applied position. To release the brakes, cam rod *1* is shifted to the right, at which admission valve *2* remains closed and drain valve *3* is opened, connecting the brake cylinders to the atmosphere through port *d* (as shown).



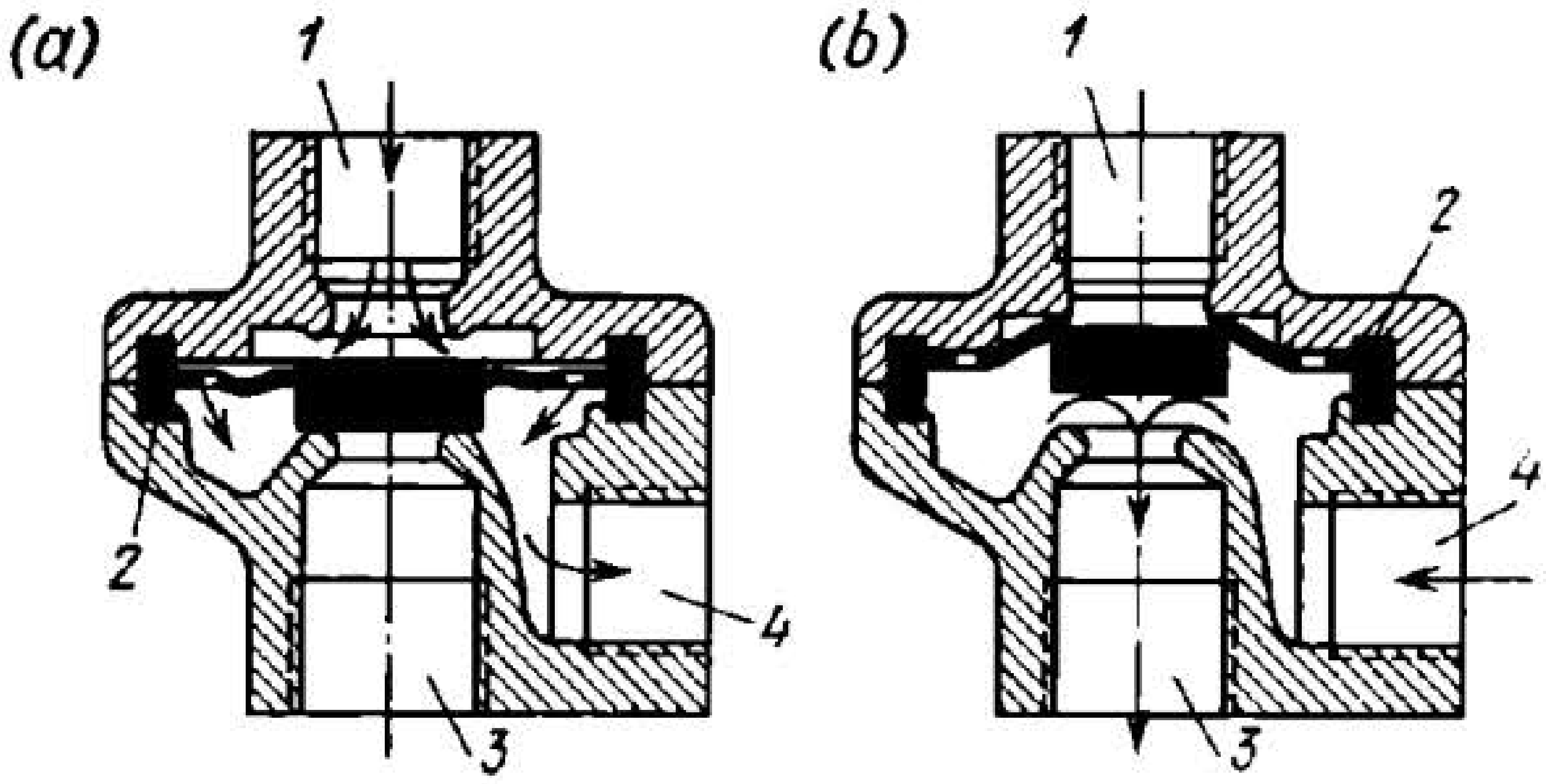
Compressed air is admitted through port 1 and flows through radial holes 2 into check valve 3, holding it against its seat, to which it is held preliminarily by helical spring 4. At the same time, the compressed air acts on the annular area outside the seat of valve 5. As the pressure increases, the force acting on this area becomes sufficient to overcome the resistance of spring 6 and the friction force, and valve 5 is shifted to the right. After the valve leaves its seat, the area on which the compressed air acts is drastically increased and the valve is reliably held in its right-hand position. Air entering port 1 passes out through port 8. The pressure at which the valve operates can be regulated by adjusting the force exerted by spring 6 using, for this purpose, threaded member 7. After valve 5 is opened, valve 3 is also opened.

SEPARATOR VALVE MECHANISM FOR EXHAUSTING MOISTURE FROM MAINS



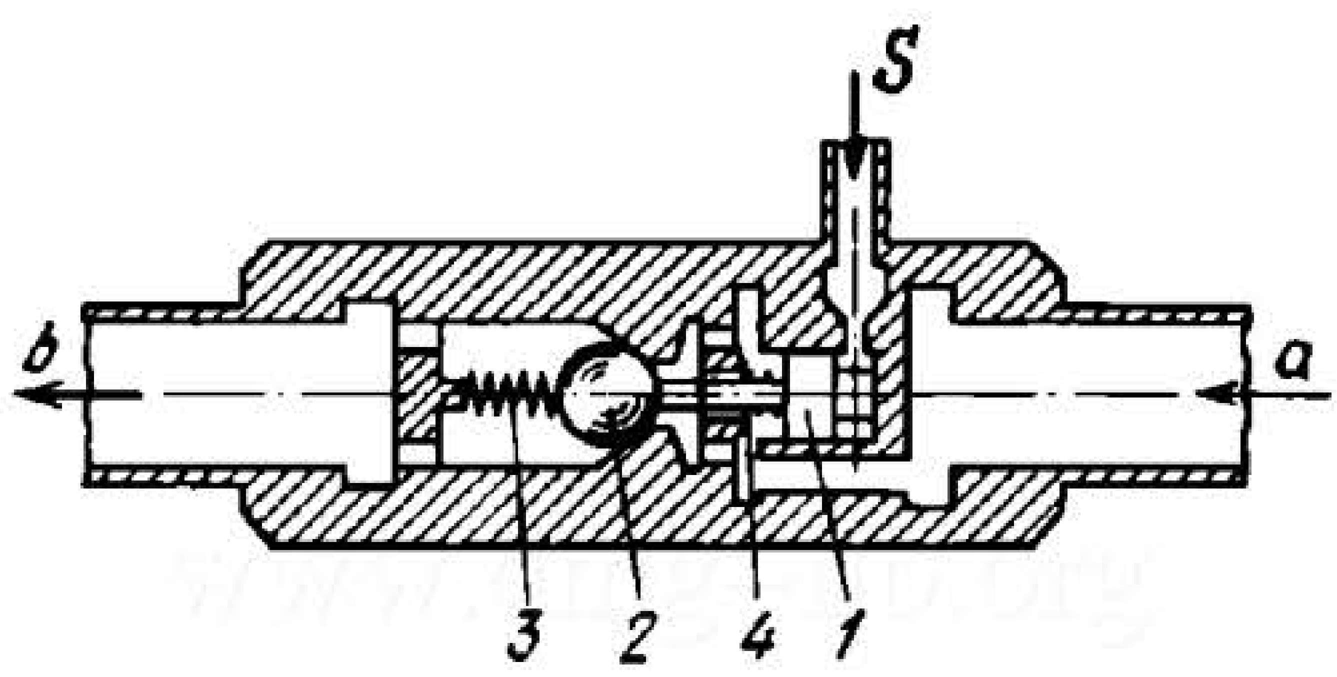
Valve operation is based on periodic pressure rise upon operation of some device in the circuit. The pipeline in which the periodic rise occurs is connected to port *1* and the tank for accumulating moisture drained from the compressed air mains is connected to port 7. The moisture fills the right end of the valve up to ball valve *6*. When the pressure is raised in port *1*, plunger *2*, overcoming the resistance of spring *3*, shifts to the right and first closes ports *4*, connected to the atmosphere, and then pushes ball *6* to the right, off its seat. At this, the moisture flows into intermediate chamber *5*. When the pressure in port *1* drops again, spring *3* returns the plunger into its initial position. First ball valve *6* closes, shutting off intermediate chamber *5* from the mains, and then the chamber is connected through ports *4* to the atmosphere. The accumulated moisture flows out through ports *4*. The cycle is repeated each time the pressure changes in port *1*. A feature of the valve is that the compressed air mains are not connected directly to the atmosphere outlet when the moisture is drained off so that no loss of compressed air occurs.

3631	DIAPHRAGM-TYPE PNEUMATIC VALVE MECHANISM FOR RAPID AIR DISCHARGE TO THE ATMOSPHERE	SHP Va



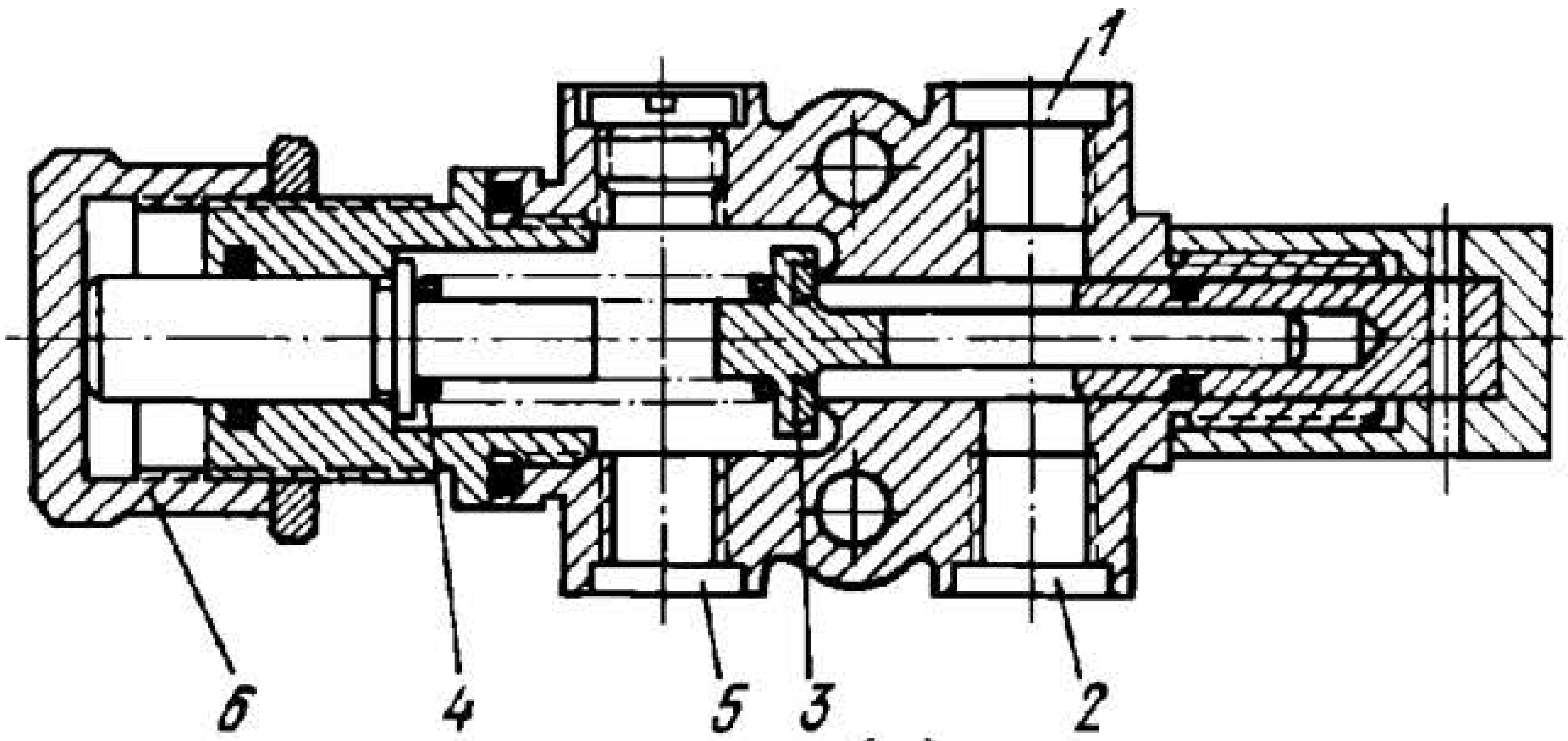
Compressed air is delivered through a directional valve to port *1* and, forcing diaphragm *2* downward shuts off port *3* which is connected to the atmosphere (Fig. *a*). The air flows through twelve peripheral holes in the diaphragm to outlet port *4* of the valve which is connected to a power cylinder. In emptying the cylinder (Fig. *b*), the directional valve connects port *1* to the atmosphere and air from the cylinder is discharged to the atmosphere through port *3*. This valve is mounted near to the cylinder and enables a large volume of air to be rapidly discharged upon emptying the cylinder without requiring large-diameter pipelines leading to the directional valve. The valve finds application for high-speed cylinders.

PILOT-CONTROLLED PNEUMATIC CHECK VALVE MECHANISM

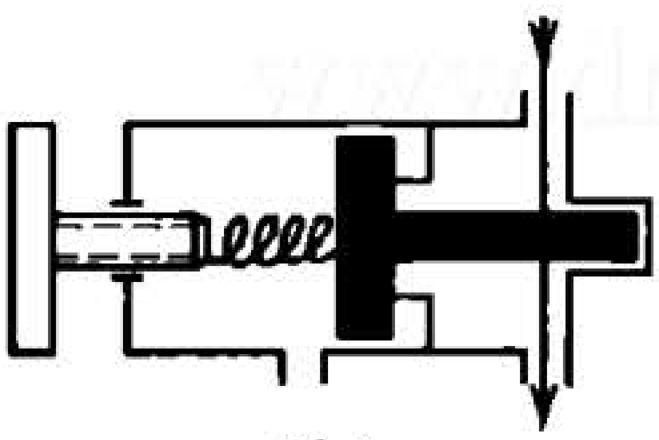


When there is no pilot signal S in the line, the mechanism operates as an ordinary ball-type check valve permitting air or liquid flow from a to b and preventing flow in the reverse direction. When signal S is received, piston *1*, owing to the pressure difference, shifts to the left, overcoming the resistance of helical spring *3* and, with its pusher *4*, moves ball *2* off its seat. The valve begins to permit air flow from b to a.

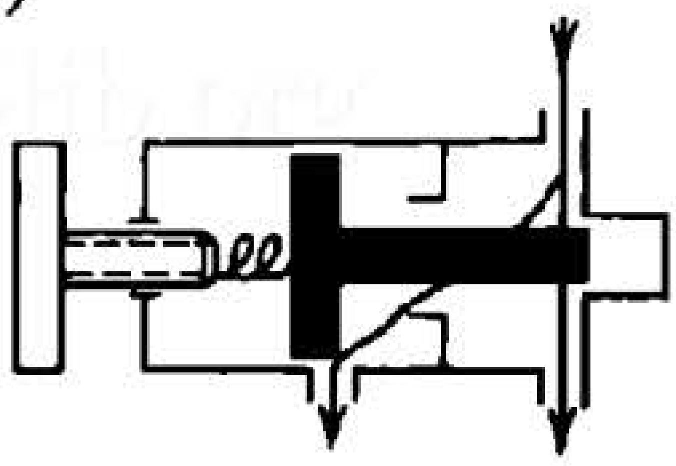
3633	PNEUMATIC SEQUENCE VALVE MECHANISM	SHP Va



(a)



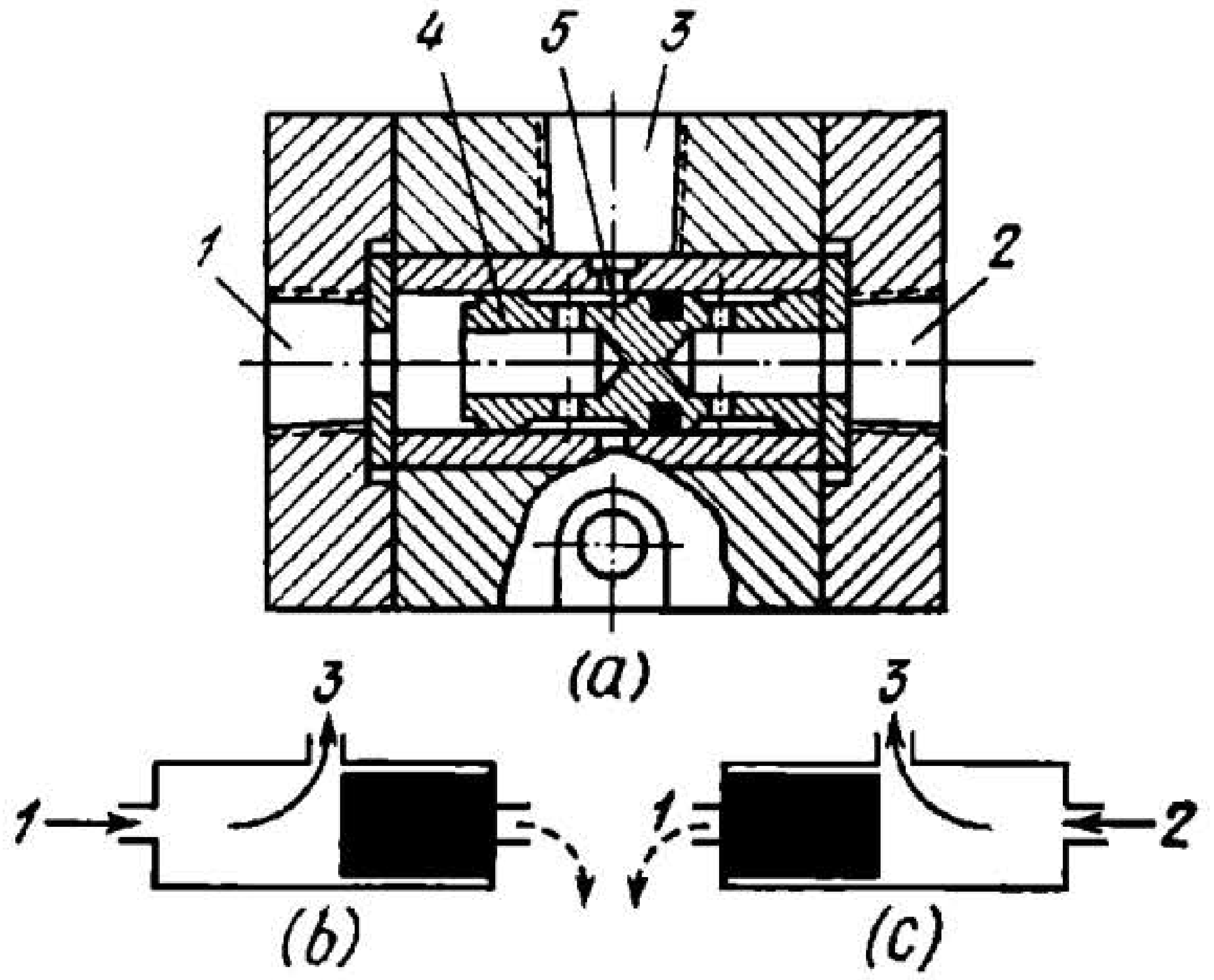
(b)



(c)

Through port *1* (Fig. *a*), compressed air flows to port *2* and further to the air chamber of the first operating device. When the pressure in this chamber has reached a certain preset limit, valve member *3* opens, overcoming the resistance of helical spring *4*, and air is admitted through port *5* to the chamber of the second operating device. In this way, consecutive operation of two devices is obtained. The pressure at which the valve is operated can be regulated by adjusting the force exerted by spring *4*. This is done by turning threaded member *6*. The principle of the valve is shown schematically in Figs. *b* and *c*.

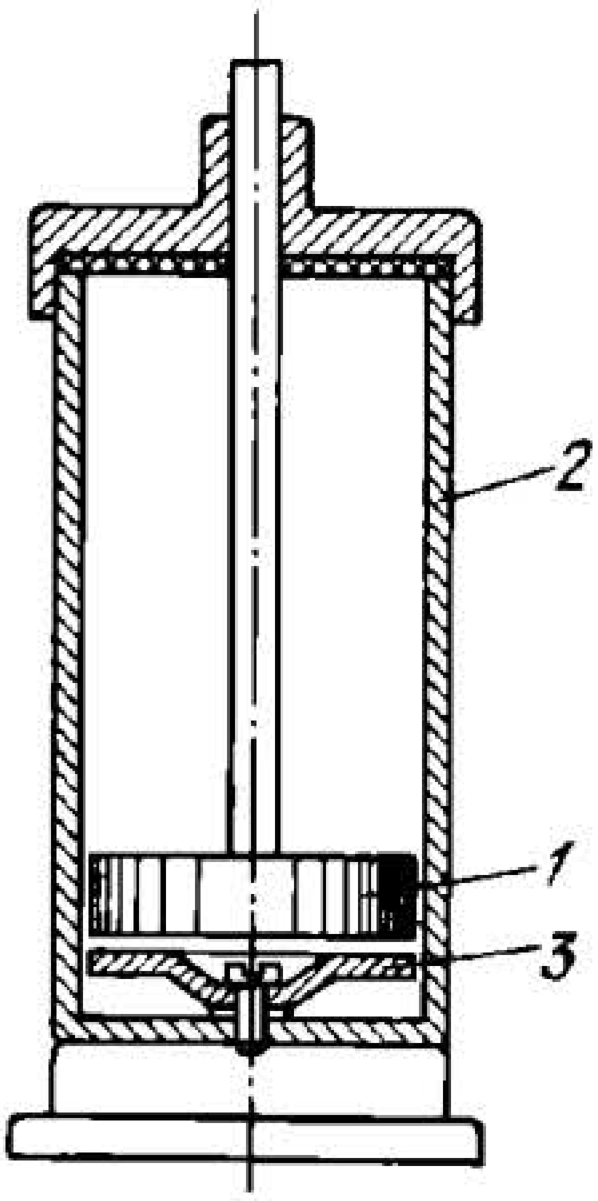
3634	PLUNGER-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP Va



This valve is intended for delivering compressed air to the exit port when it enters from either of two admission ports, the other port being connected at this time to the atmosphere. Air entering through port *1* shifts plunger *4* to the position shown and flows through passages in the plunger and port *5* to port *3* (Fig. *a*). The plunger shuts off air flow from port *1* to port *2* which, at this time, is connected to the atmosphere. If air is delivered through port *2* and port *1* is connected to the atmosphere, the plunger is shifted by air pressure to the left and air from port *2* flows out through port *3*. If air is delivered simultaneously to both inlet ports, it flows to port *3*. This valve can be employed for obtaining logic function "OR" by pneumatic means in control design. The principle of the valve is shown schematically in Figs. *b* and *c*.

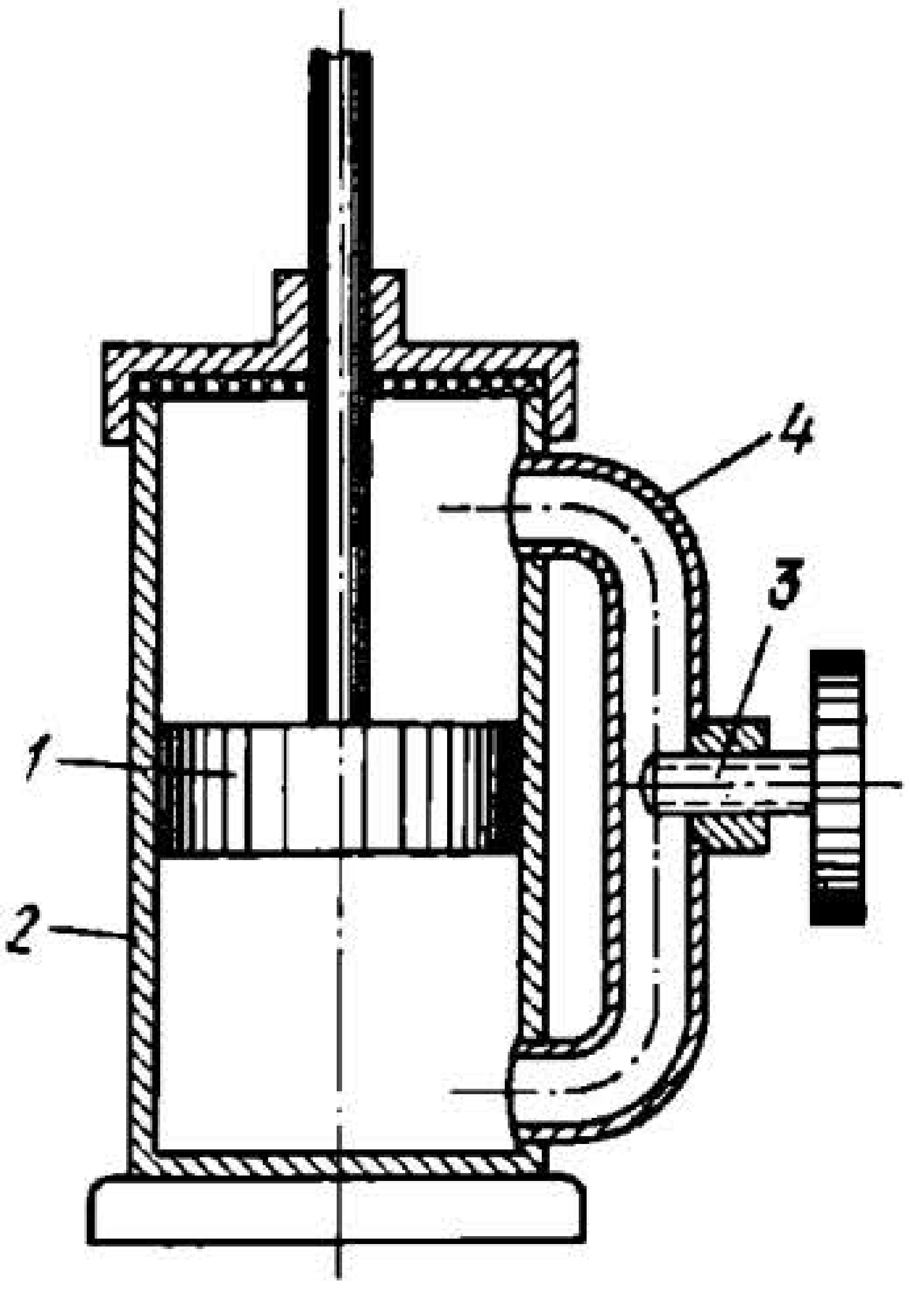
2. DAMPER AND CATARACT MECHANISMS
(3635 through 3645)

3635	PISTON-TYPE REGULATOR DAMPER MECHANISM WITH HIGHER BRAKING ACTION AT THE BEGINNING OF THE STROKE	SHP DC



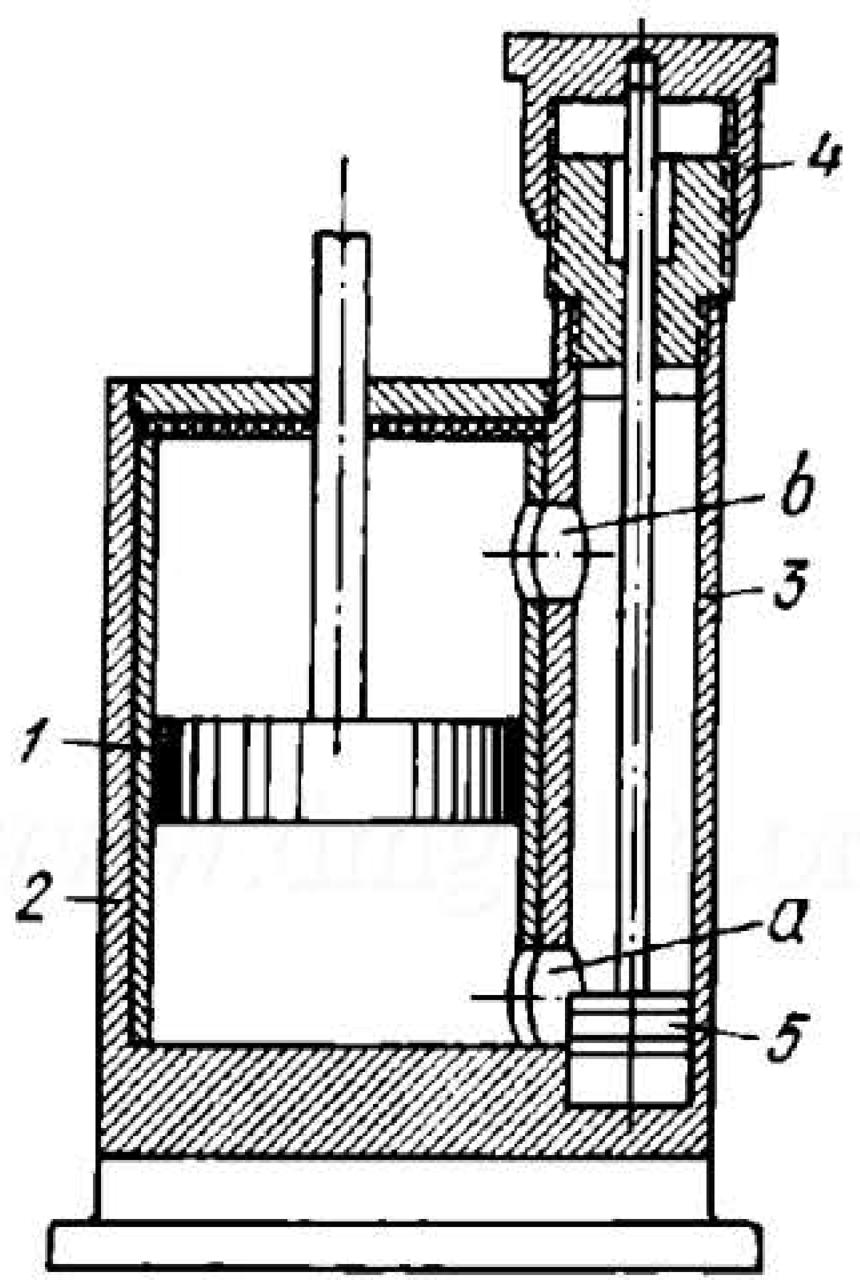
As piston *1* travels in cylinder *2*, filled with a viscous liquid, a braking effect is obtained. Since in its extreme lower position, piston *1* contacts plate *3*, in its upward stroke it must overcome the cohesive forces in the layer of liquid between the piston and plate. This increases the braking force at the start of the stroke.

3636	PISTON-TYPE REGULATOR DAMPER MECHANISM WITH VARIABLE BRAKING FORCE	SHP DC



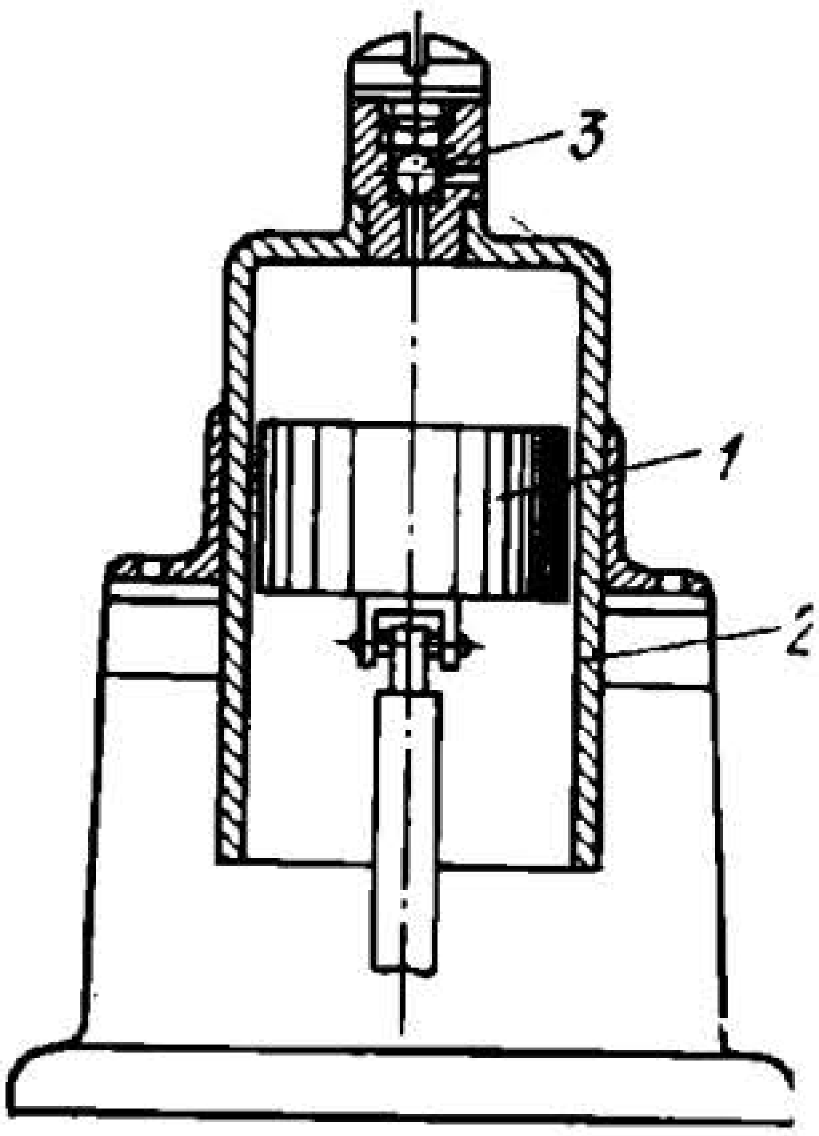
As piston *1* travels in cylinder *2*, filled with a viscous liquid, a braking effect is obtained whose magnitude can be varied by means of screw *3* and connecting pipe *4*. This pipe connects the ends of cylinder *2*, and screw *3* can vary the resistance to flow in this pipe.

3637	PISTON-TYPE REGULATOR DAMPER MECHANISM WITH VARIABLE BRAKING FORCE	SHP DC



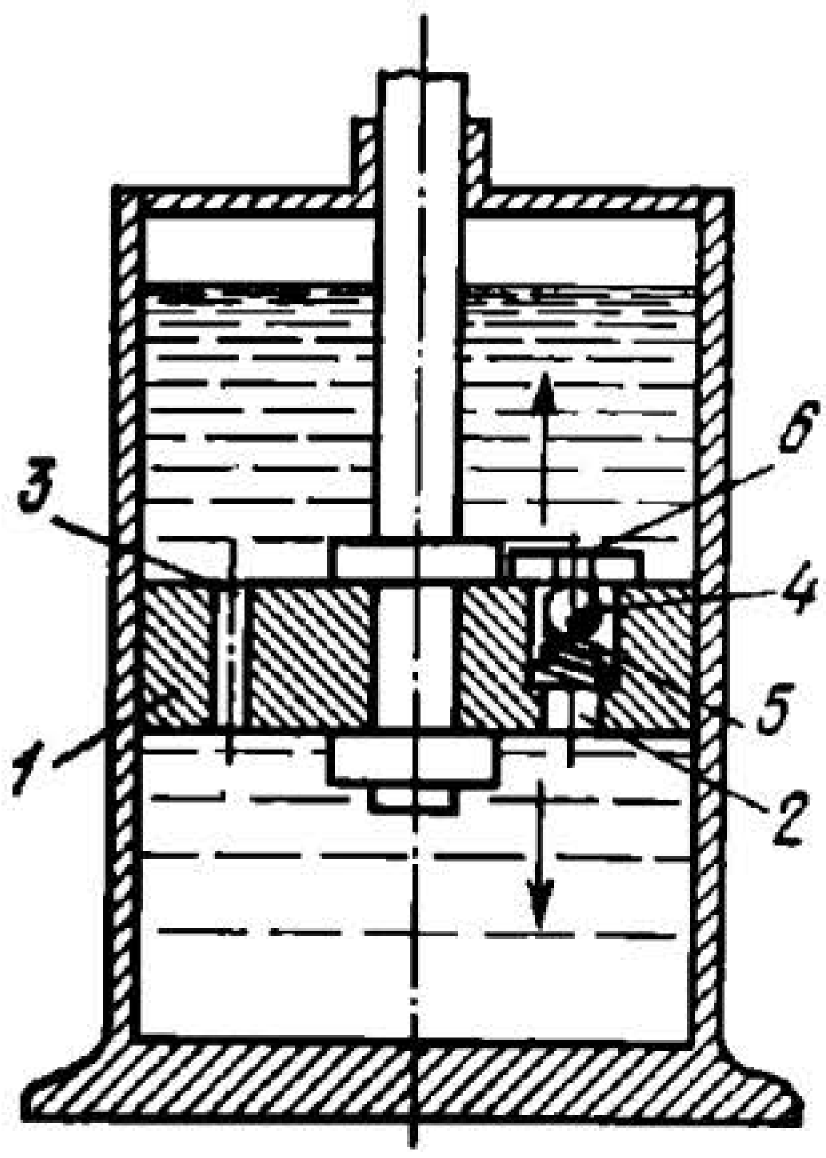
As piston *1* travels in cylinder *2*, filled with a viscous liquid, a braking effect is obtained whose magnitude can be varied by means of supplementary cylinder *3* which connects ports *a* and *b* of main cylinder *2*. Piston *5* in cylinder *3*, adjusted vertically by threaded member *4*, regulates the opening of port *a* and the flow of liquid through this port.

3638	PISTON-TYPE REGULATOR DAMPER MECHANISM	SHP DC



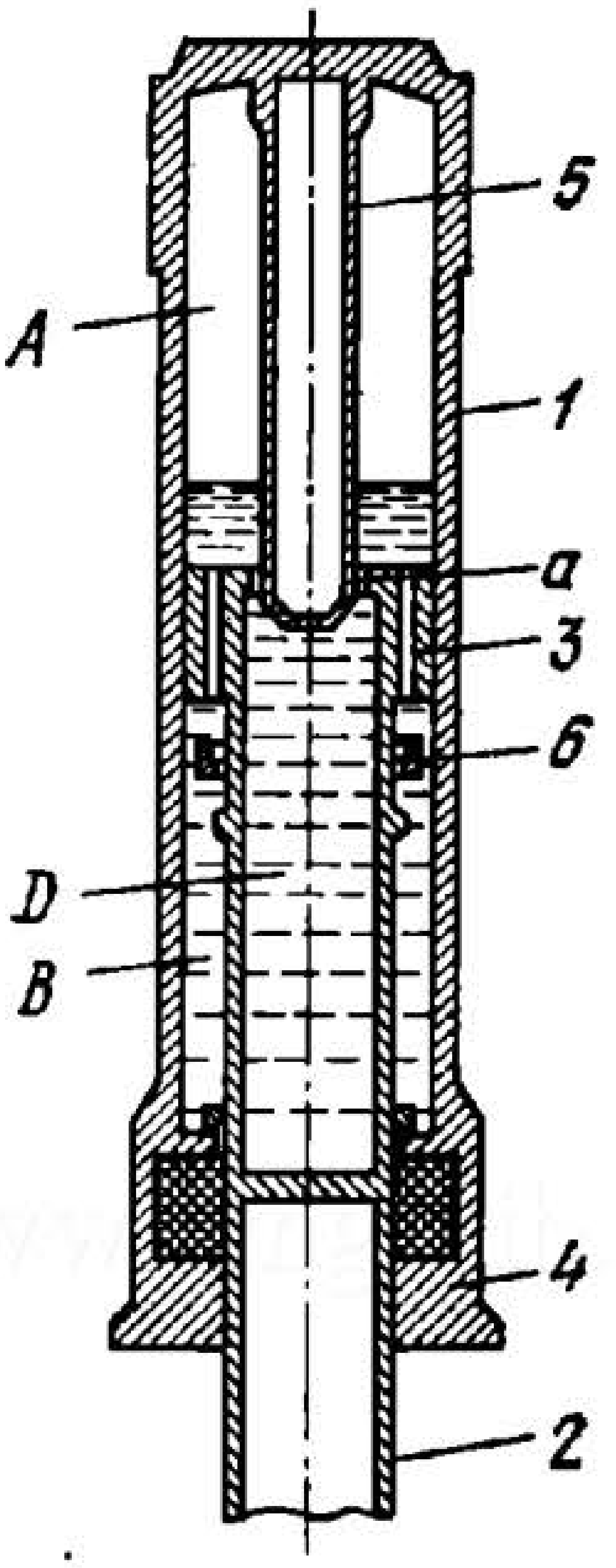
As piston 1 travels downward in cylinder 2, a braking effect is obtained and air is drawn through the clearance between the wall of cylinder 2 and the piston into the upper end of the cylinder. But when piston 1 travels upward, air flows out both through the clearance and through ball-type check valve 3 which is opened by the air. This sharply reduces the braking effect.

3639	PISTON-TYPE HYDRAULIC DAMPER MECHANISM WITH A BALL CHECK VALVE	SHP DC



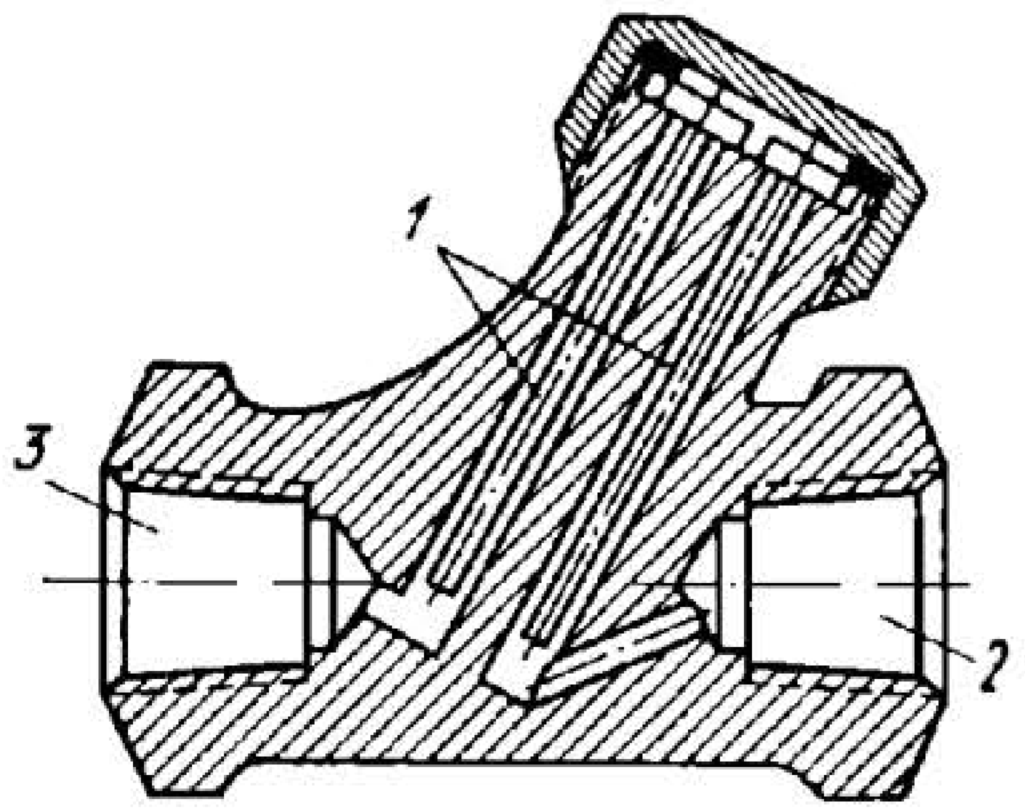
Piston 1 has holes 2 and 3. Ball-type check valve 4 is mounted in hole 2. As the piston travels upward, ball 4, owing to the resistance of the viscous liquid in the cylinder, compresses spring 5 and opens hole 6. As piston 1 travels downward, ball 4 closes hole 6. This provides for different speeds of piston travel in the up and down strokes.

3640	HYDROPNEUMATIC SHOCK ABSORBER MECHANISM FOR AIRCRAFT WHEELS	SHP DC



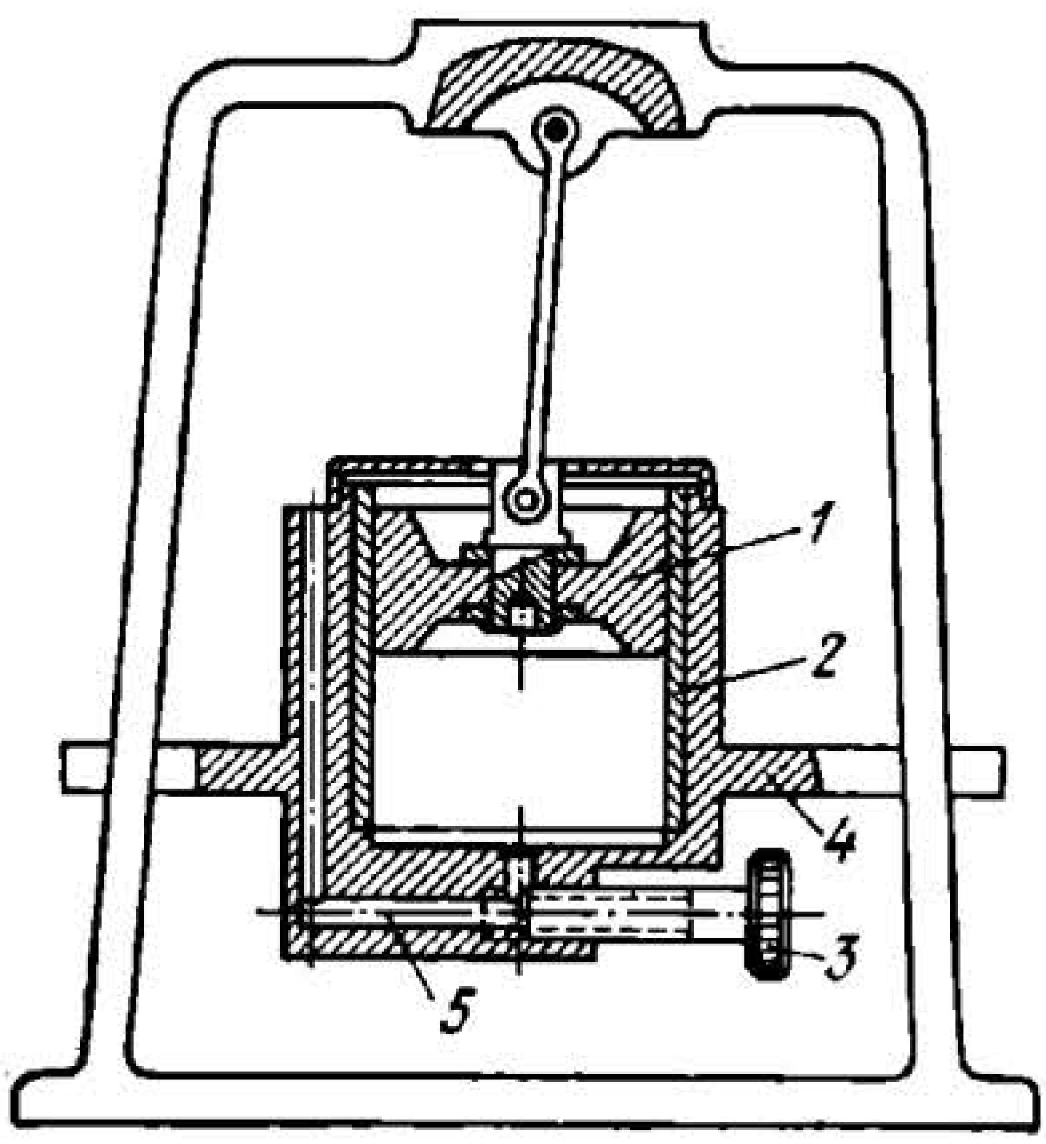
Cylinder 1 is secured to the frame structure of the aircraft. Member 2 carries an aircraft wheel and has two bearings in cylinder 1: upper guiding sleeve 3 and lower bearing 4. Plunger 5 is rigidly secured to cylinder 1. Mounted on member 2 is reversing brake valve 6. Chamber *A* is filled with air under pressure. Chambers *D* and *B* are filled with a liquid. An annular clearance *a* for liquid flow is provided between member 2 and plunger 5. When the aircraft lands and the wheels strike the ground, member 2 travels upward. The air in the cylinder is compressed. Liquid is displaced from chamber *D* through annular clearance *a* into cylinder 1 and then through the holes in guiding sleeve 3, forcing away valve 6 up to its stop and, passing by this valve, filling chamber *B*. In the reverse stroke, member 2, owing to air pressure, travels downward and liquid from chamber *B* begins to flow into chamber *A*. At this, valve 6 is forced against upper guiding sleeve 3 and closes all of its holes for the down stroke, leaving only holes in the valve itself for liquid flow. From chamber *A*, the liquid flows into chamber *D* through annular clearance *a*.

3641	DAMPER MECHANISM FOR ELIMINATING PRESSURE GAUGE HAND OSCILLATION	SHP DC



The pulsation of the stream of fluid flowing through ports *2* and *3* of the throttling device mounted in the pressure gauge sets up vibrations of pins *1* in their recesses. This damps the pulsations of the fluid and the corresponding oscillations of the pressure gauge hand.

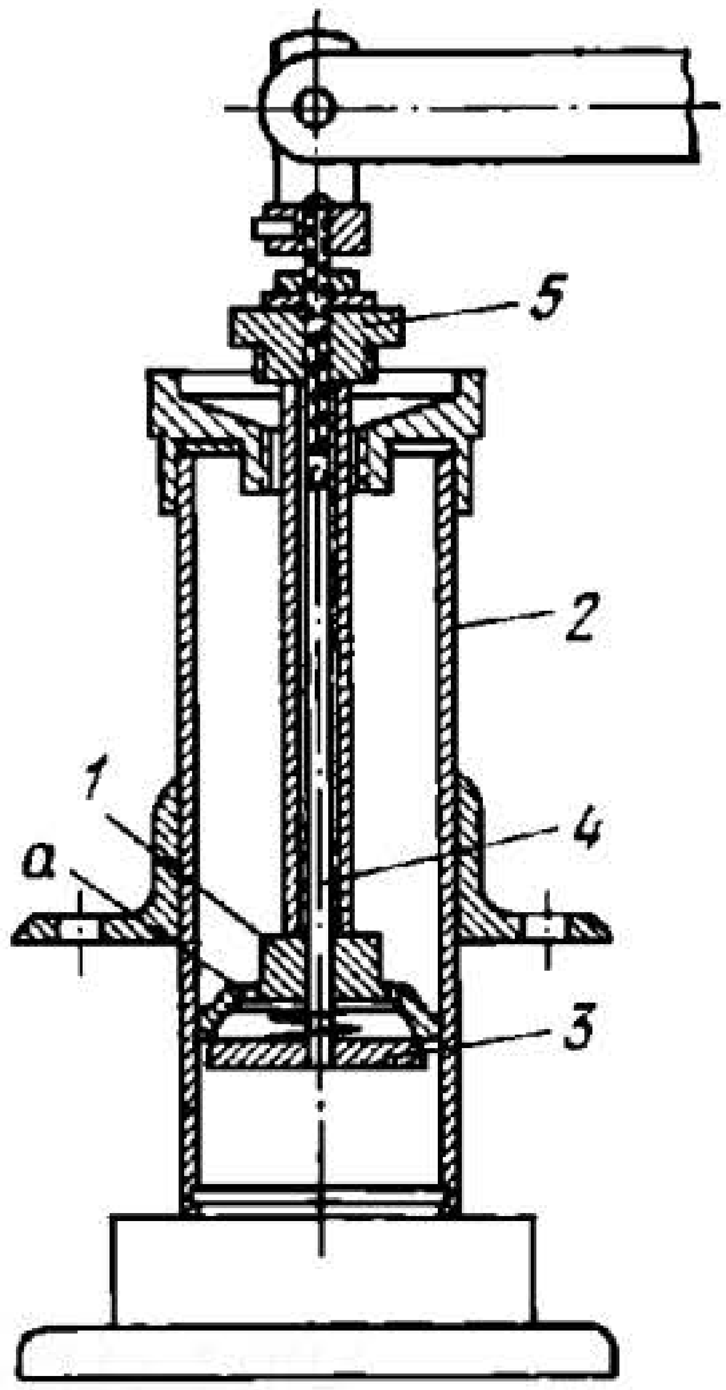
3642	PISTON-TYPE PNEUMATIC DAMPER MECHANISM FOR SCALES	SHP DC



The damping of the oscillations of scales, secured to body *4* of the damper, is accomplished by piston *1* which travels in cylinder *2*. The degree of damping is regulated by screw *3* which varies the clear opening in air channel *5*.

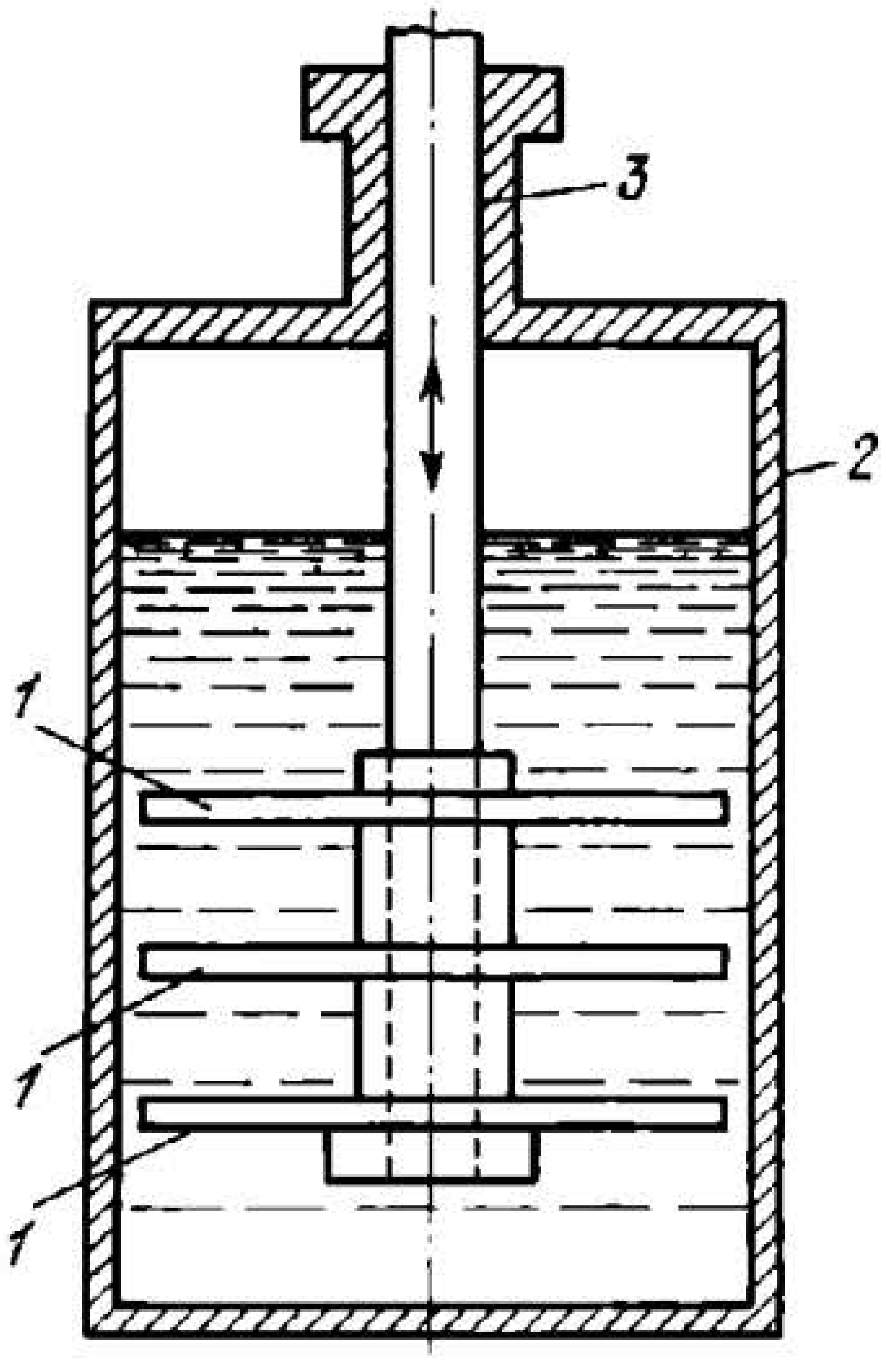
3643	PISTON-TYPE HYDRAULIC DAMPER MECHANISM FOR SCALES	SHP DC

The oscillations of scales, secured to cylinder *2*, are damped in the travel of piston *1* which has a number of holes *a* for the flow of fluid from one end of the cylinder to the other. By setting piston *1*, using nut *5*, at various distances from disk *3* to vary the clearance between the edges of the piston and disk, the degree of damping of scale oscillation can be changed. Disk *3* is mounted rigidly on rod *4*.

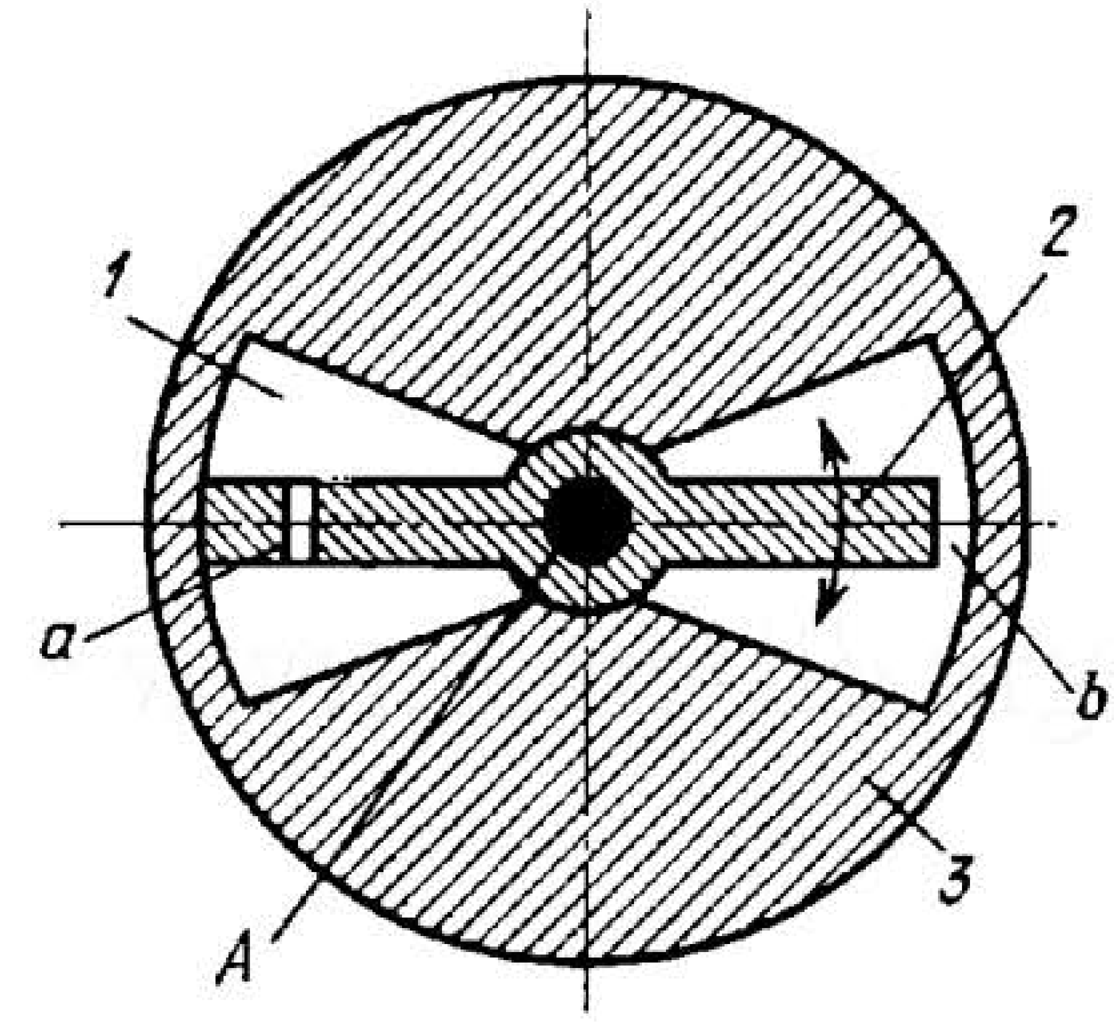


3644	PISTON-TYPE HYDRAULIC CATARACT MECHANISM	SHP DC

The diameter of disks *1* is slightly less than the bore of cylinder *2*. As piston rod *3* travels upward or downward, the liquid retards or damps its motion.



3645	VANE-TYPE HYDRAULIC CATARACT MECHANISM	SHP DC

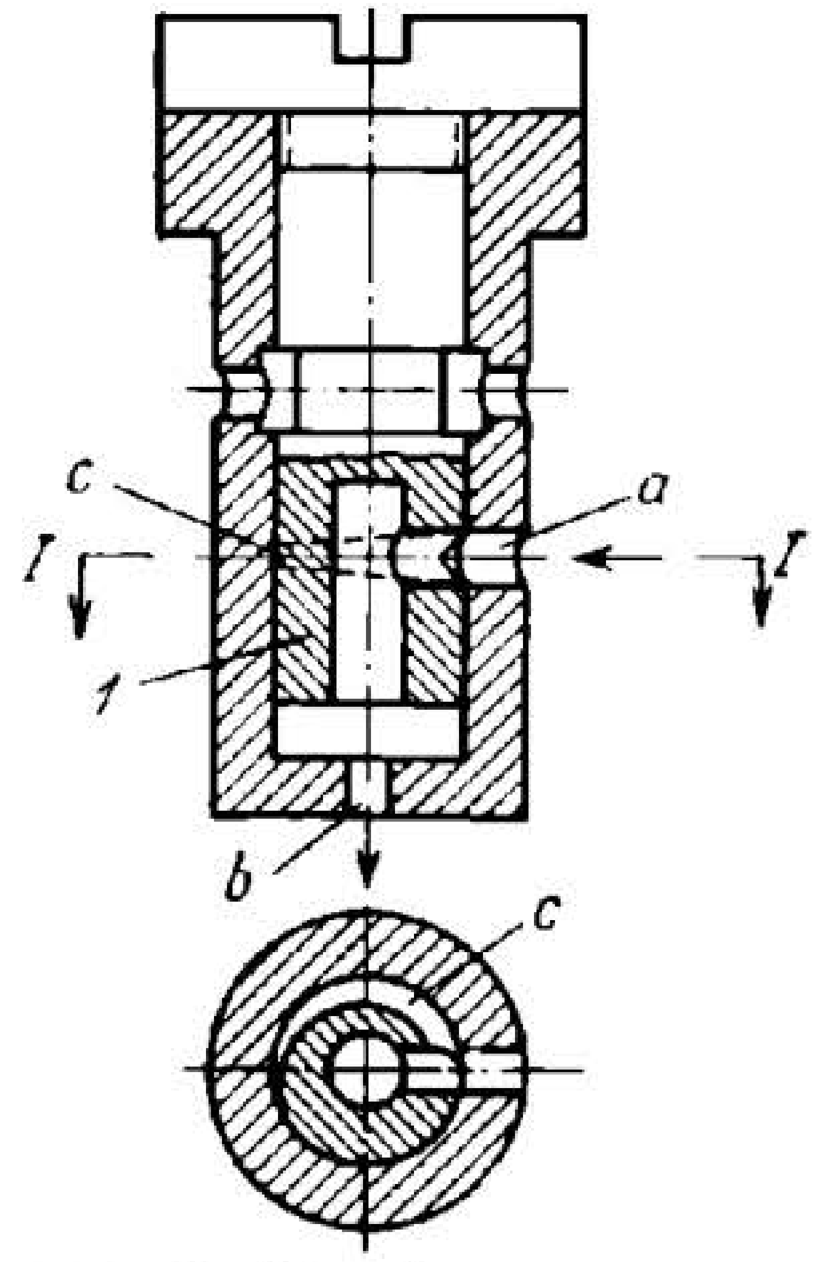


Vane *2*, turning about fixed axis *A*, is in a liquid which fills chamber *1*. Damping of the oscillations of the vane is accomplished by the provision of hole *a* in vane *2* and clearance *b* between vane *2* and housing *3*.

3. FLOW-CONTROL AND DIRECTIONAL VALVE MECHANISMS (3646 through 3697)

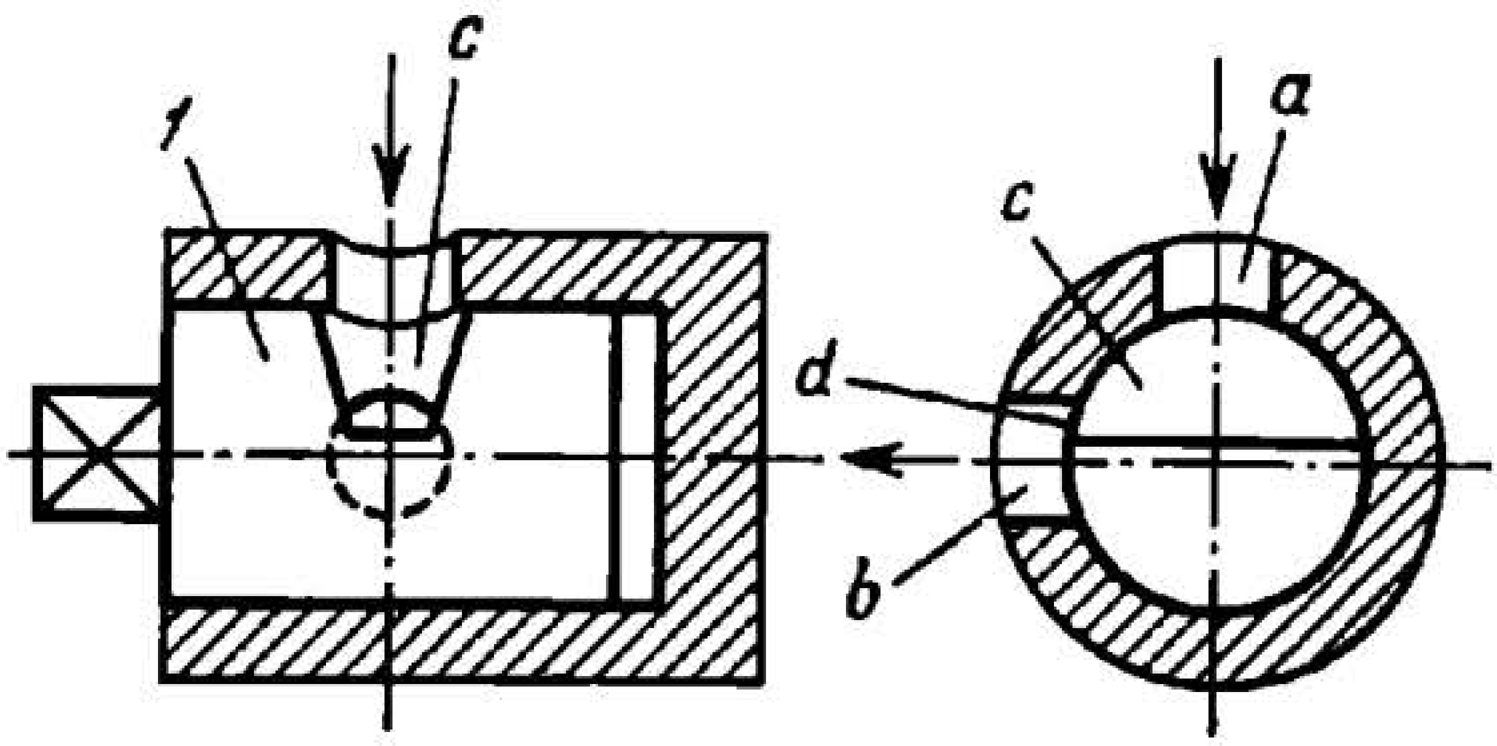
3646	SLIT-TYPE FLOW-CONTROL VALVE MECHANISM	SHP FC

Over a part of its circumference, plug *1* of the valve has groove (slit) *c* of variable triangular cross section. As plug *1* is turned, the area of the cross section of groove *c* opposite port *a* is varied. This varies the pressure difference (and rate of flow) between ports *a* and *b*.



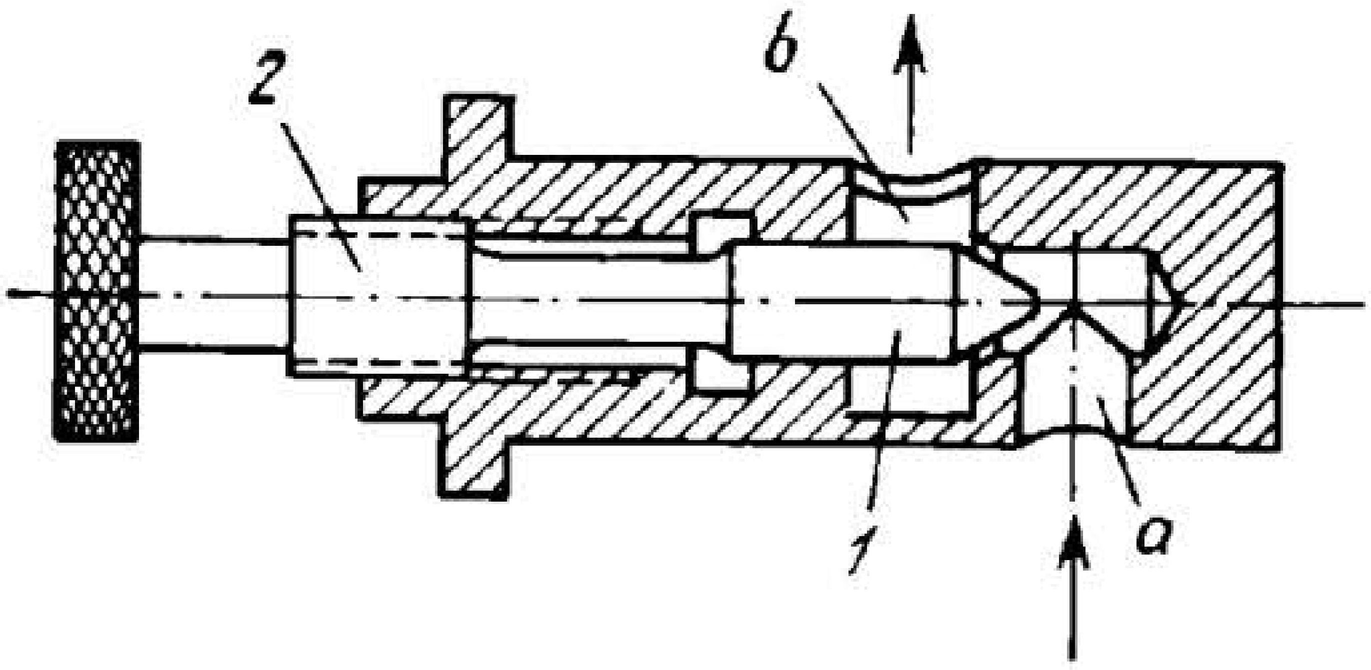
Section I-I

3647	SLIT-TYPE FLOW-CONTROL VALVE MECHANISM	SHP FC



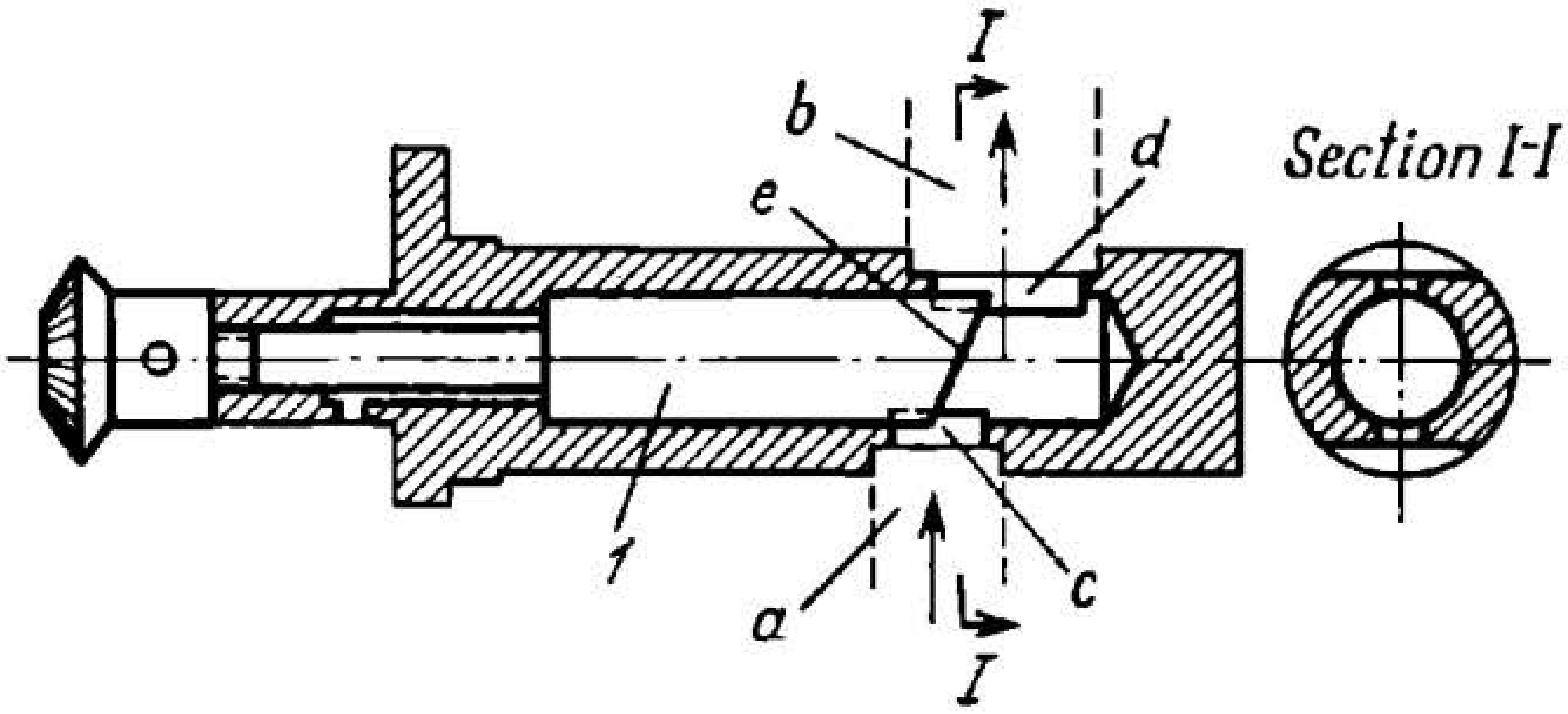
Plug *1* has groove (slit) *c* of trapezoidal cross section. Fluid, flowing from port *a* to port *b* or vice versa, flows through opening *d* formed by the edges of port *b* and groove *c*. As plug *1* is turned, opening *d* is varied, thereby varying the pressure difference (and rate of flow) between ports *a* and *b* (or *b* and *a*).

3648	NEEDLE-TYPE FLOW-CONTROL VALVE MECHANISM	SHP FC



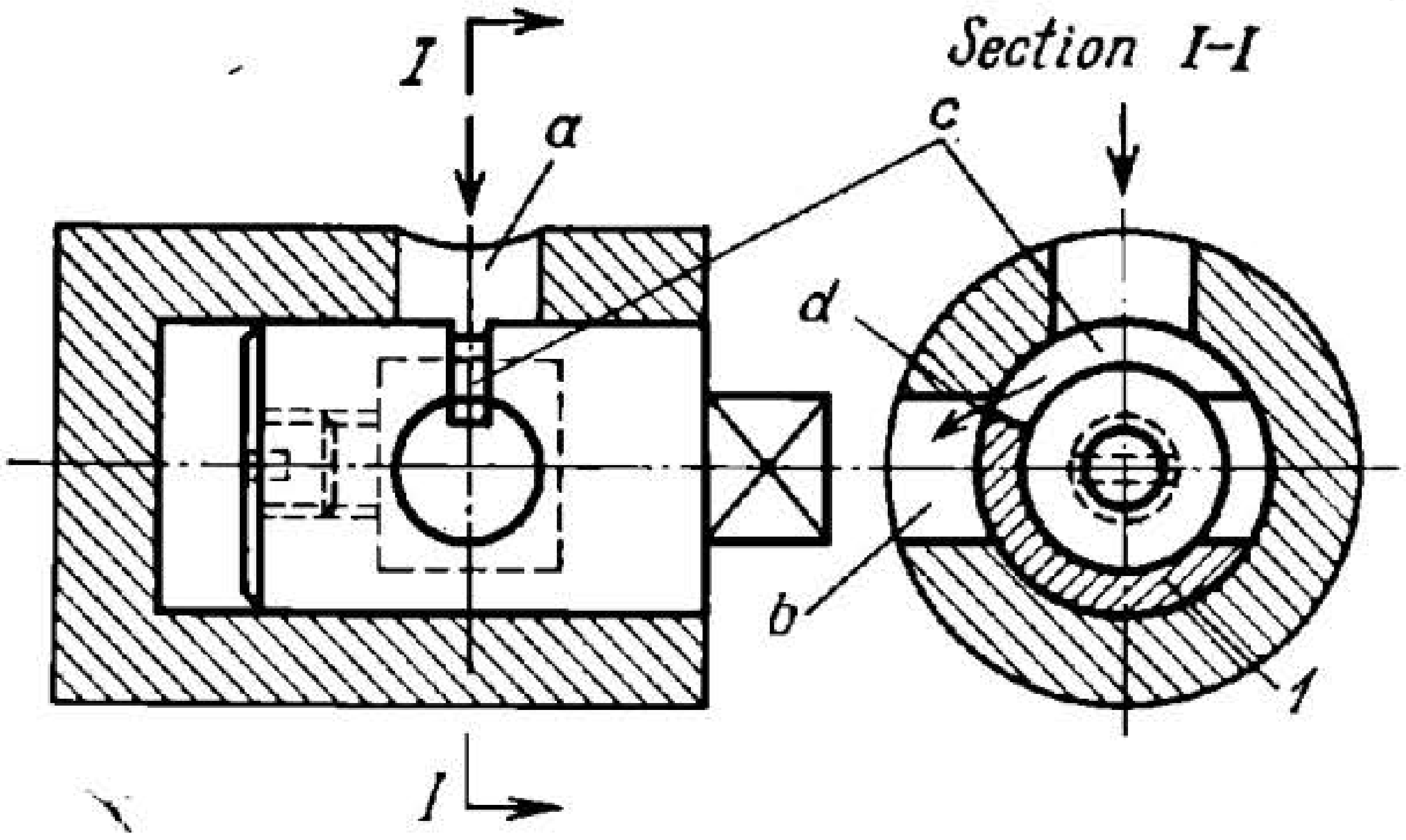
Ports *a* and *b* are connected together through an annular slit between needle *1* and its seat. This sets up a pressure difference upon the flow of fluid. Adjusting needle *1* with screw *2* varies the annular slit and, consequently, the pressure difference (and rate of flow) between ports *a* and *b*.

3649	SLIDING FLOW-CONTROL VALVE MECHANISM	SHP FC



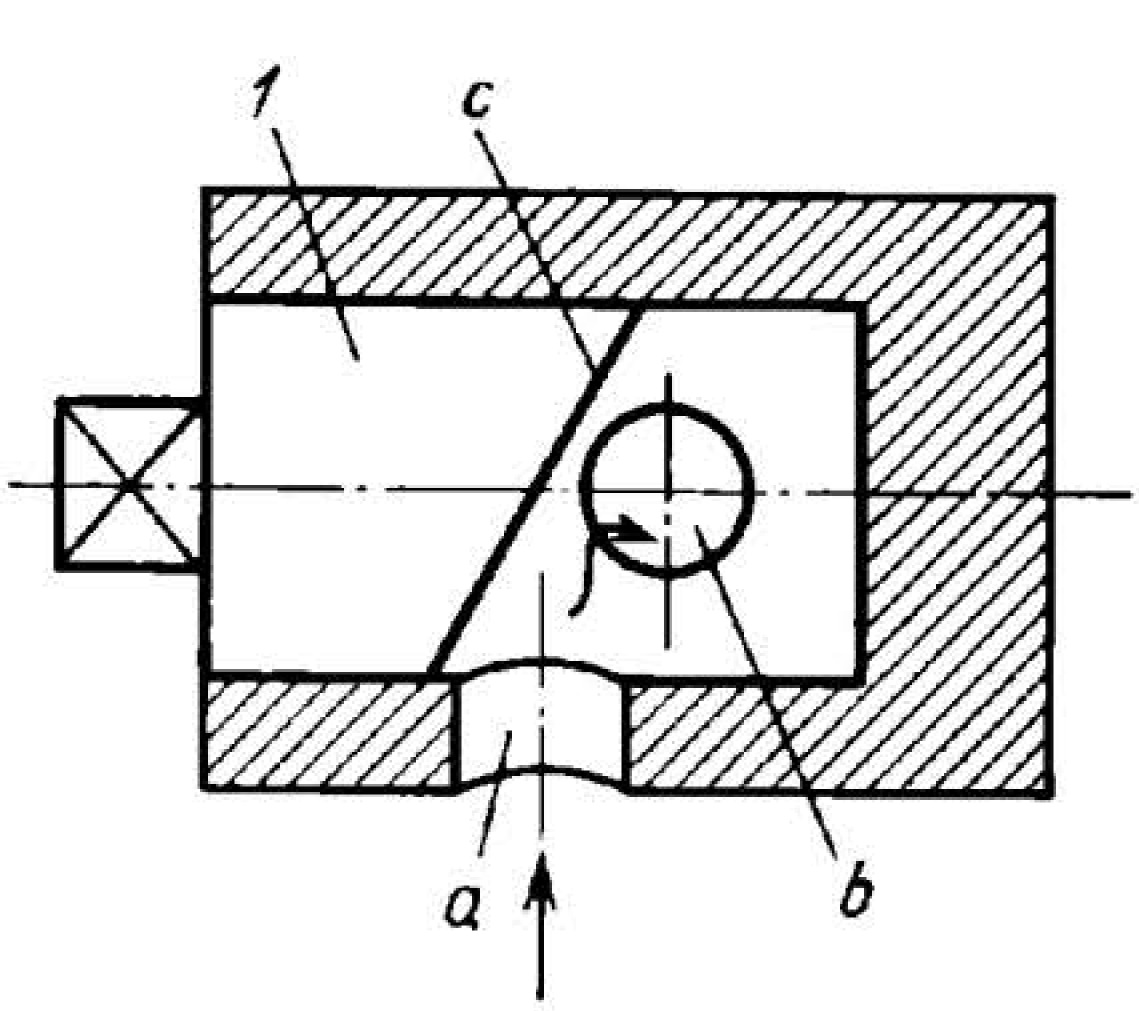
Ports *a* and *b* are connected together by slots *c* and *d* so that a pressure difference is set up upon the flow of fluid between them. As plug *1* with its bevelled end *e* is adjusted axially, the clear openings of slots *c* and *d* are changed, as consequently, is the pressure difference (and rate of flow) between ports *a* and *b*.

3650	SLIT-TYPE FLOW-CONTROL VALVE MECHANISM	SHP FC



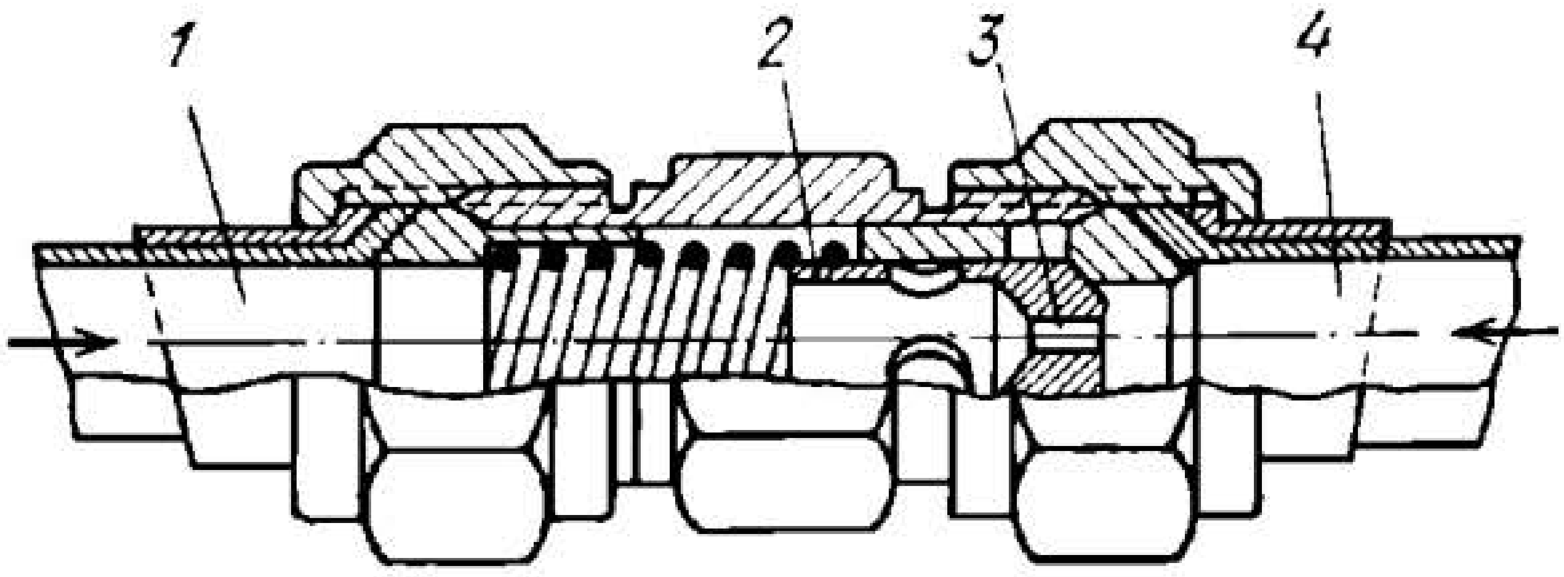
Over a part of its circumference, plug *1* of the valve has groove (slit) *c*. Fluid, flowing from port *a* to port *b* or vice versa, flows through opening *d* formed by the edges of port *b* and groove *c*. As plug *1* is turned, opening *d* is varied, thereby varying the pressure difference (and rate of flow) between ports *a* and *b* (or *b* and *a*).

3651	GRINDER FLOW-CONTROL VALVE MECHANISM	SHP FC



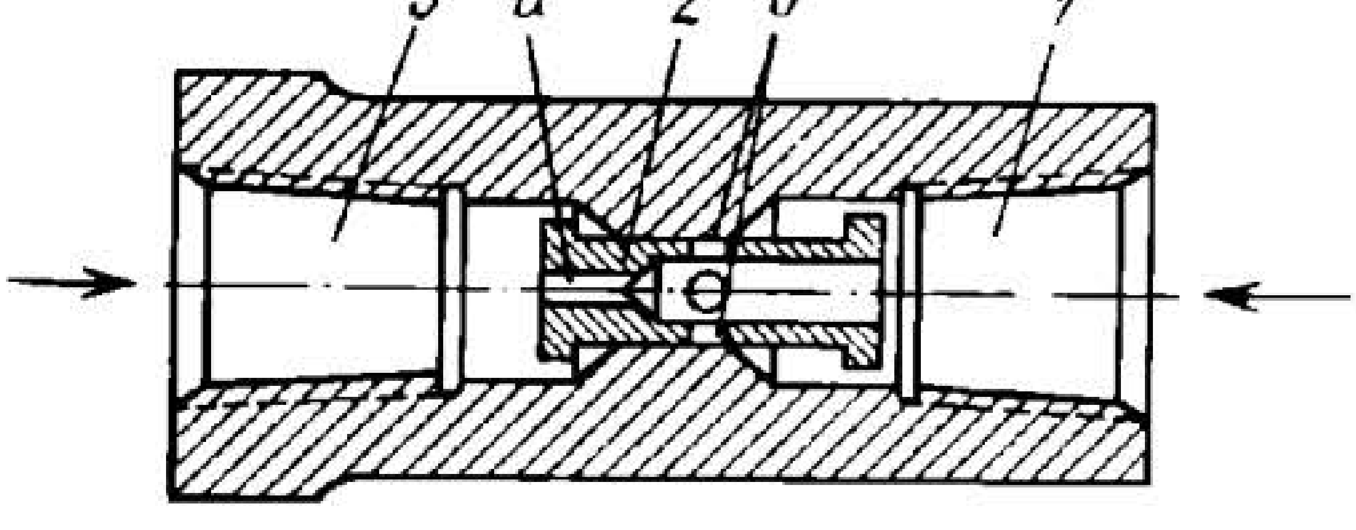
As plug *1* is turned, its bevelled end *c* varies the clear openings of ports *a* and *b*, thereby varying the pressure difference (and rate of flow) between these ports.

3652	ONE-WAY FLOW-CONTROL VALVE MECHANISM	SHP FC

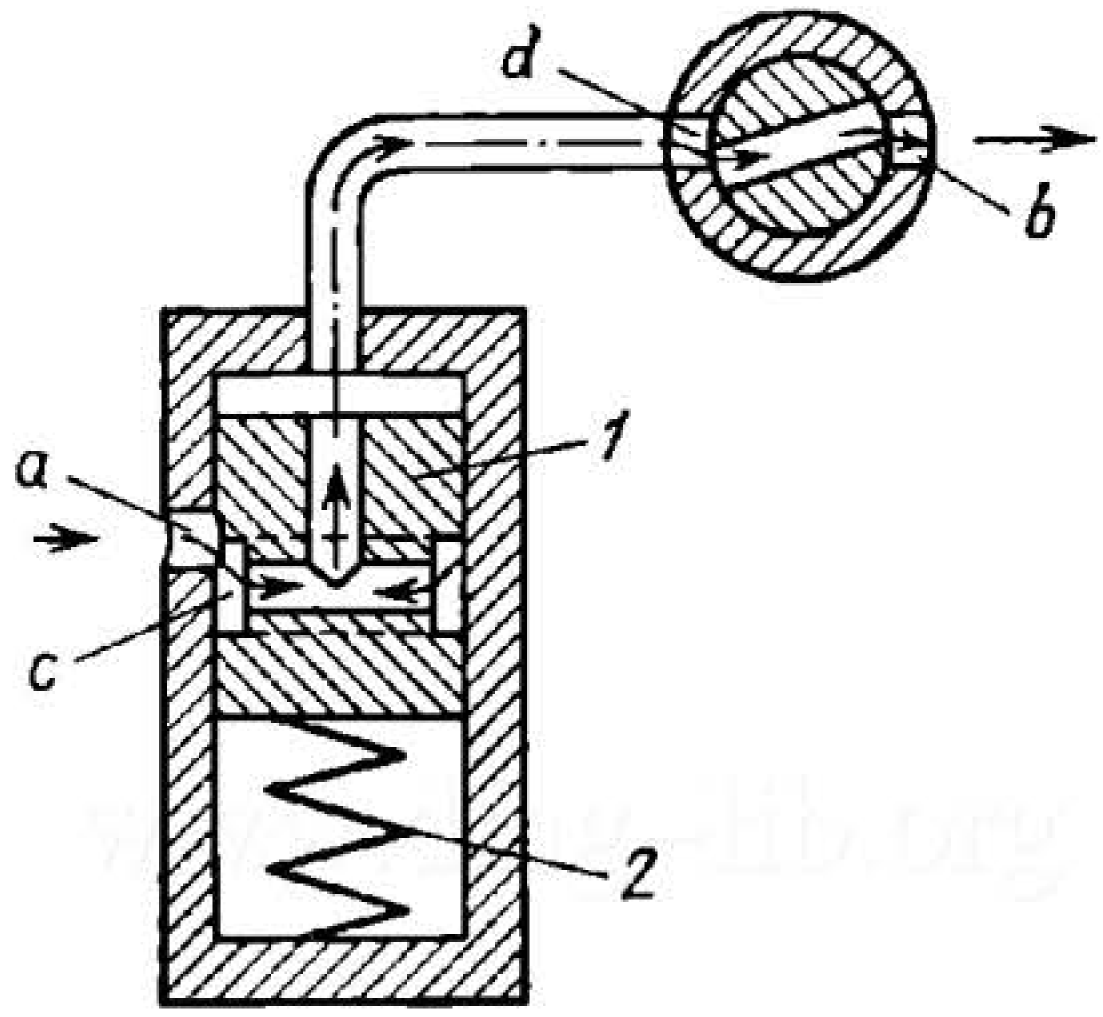


As fluid flows through channel *1* to the right, valve member *2* is pressed into its seat and the fluid can flow only through orifice *3*. When fluid flows through channel *4* to the left, it pushes back valve member **2**, compressing the spring and allowing free flow.

3653	ONE-WAY FLOW-CONTROL VALVE MECHANISM	SHP FC

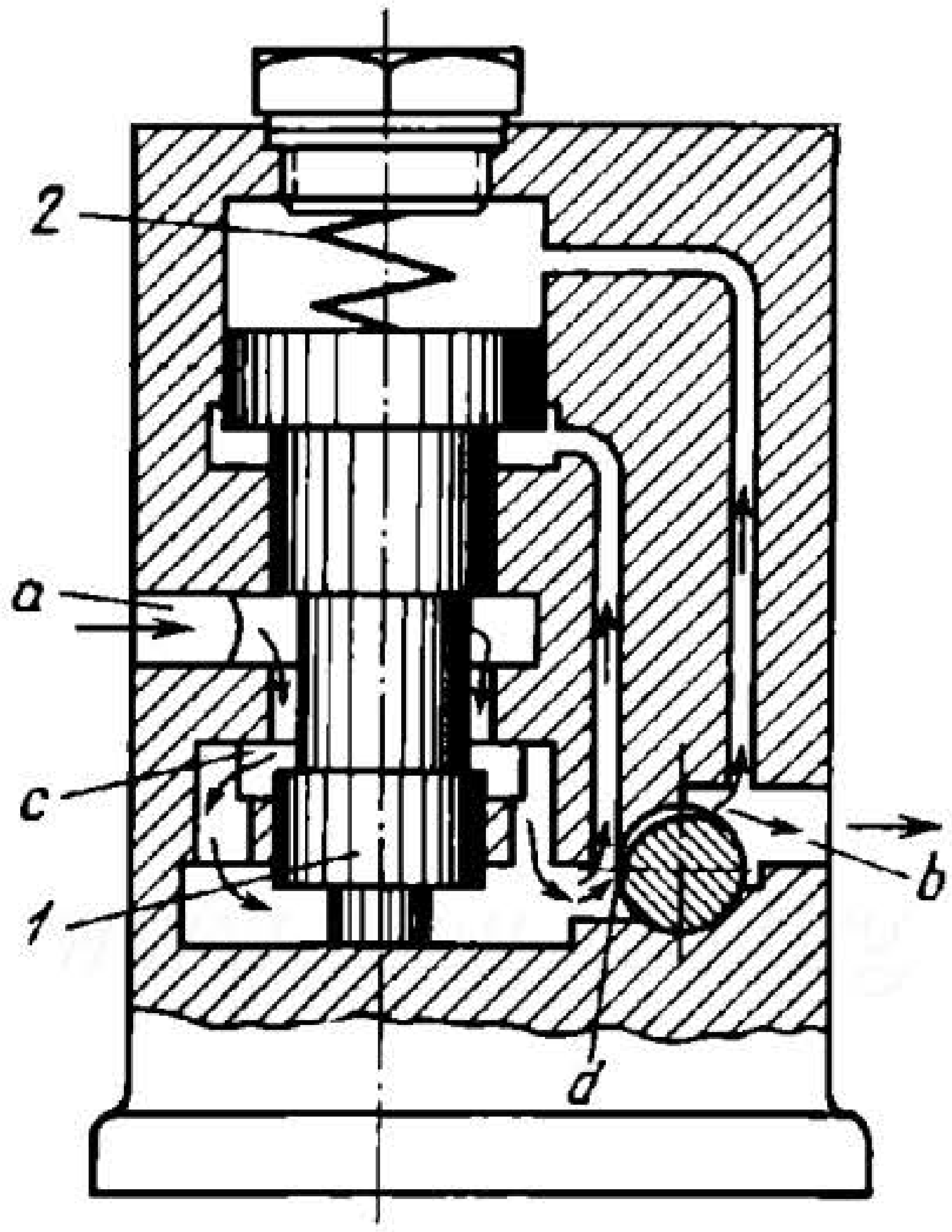


When fluid flows through port *1* to the left, plunger *2* is shifted axially and the fluid flows through longitudinal hole *a* and transverse holes *b* in the plunger. Upon reversal of flow, i.e. through port *3* to the right, plunger *2* is also shifted (to the right) but now transverse holes *b* are closed and fluid flows only through longitudinal hole *a*.



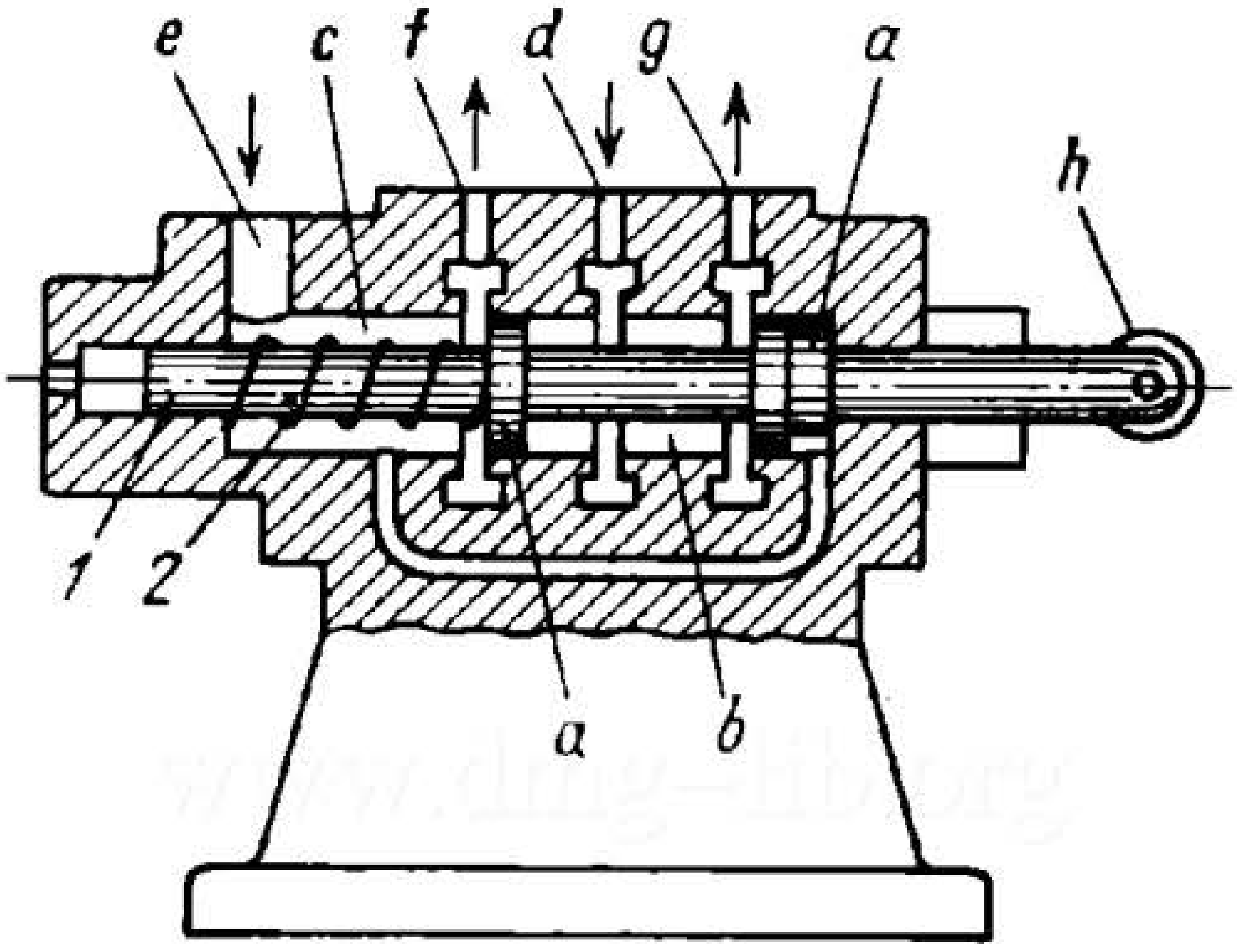
Fluid flowing from port *a* to port *b* passes through throttling orifice *c* of the first flow-control unit and throttling orifice *d* of the second unit. Piston *1* is subject below to the action of spring *2*, and above to the pressure of the fluid after first flow control. When the pressure in port *a* exceeds a definite value, piston *1* moves downward and closes throttling orifice *c*. Since the discharge through throttling orifice *d* continues, the pressure above piston *1* drops and the piston rises, opening throttling orifice *c* again. In this way, fluctuations in flow of the fluid passing through the flow-control valve, due to fluctuations in pressure preceding the valve, are reduced.

3655	DOUBLE FLOW-CONTROL VALVE MECHANISM	SHP FC

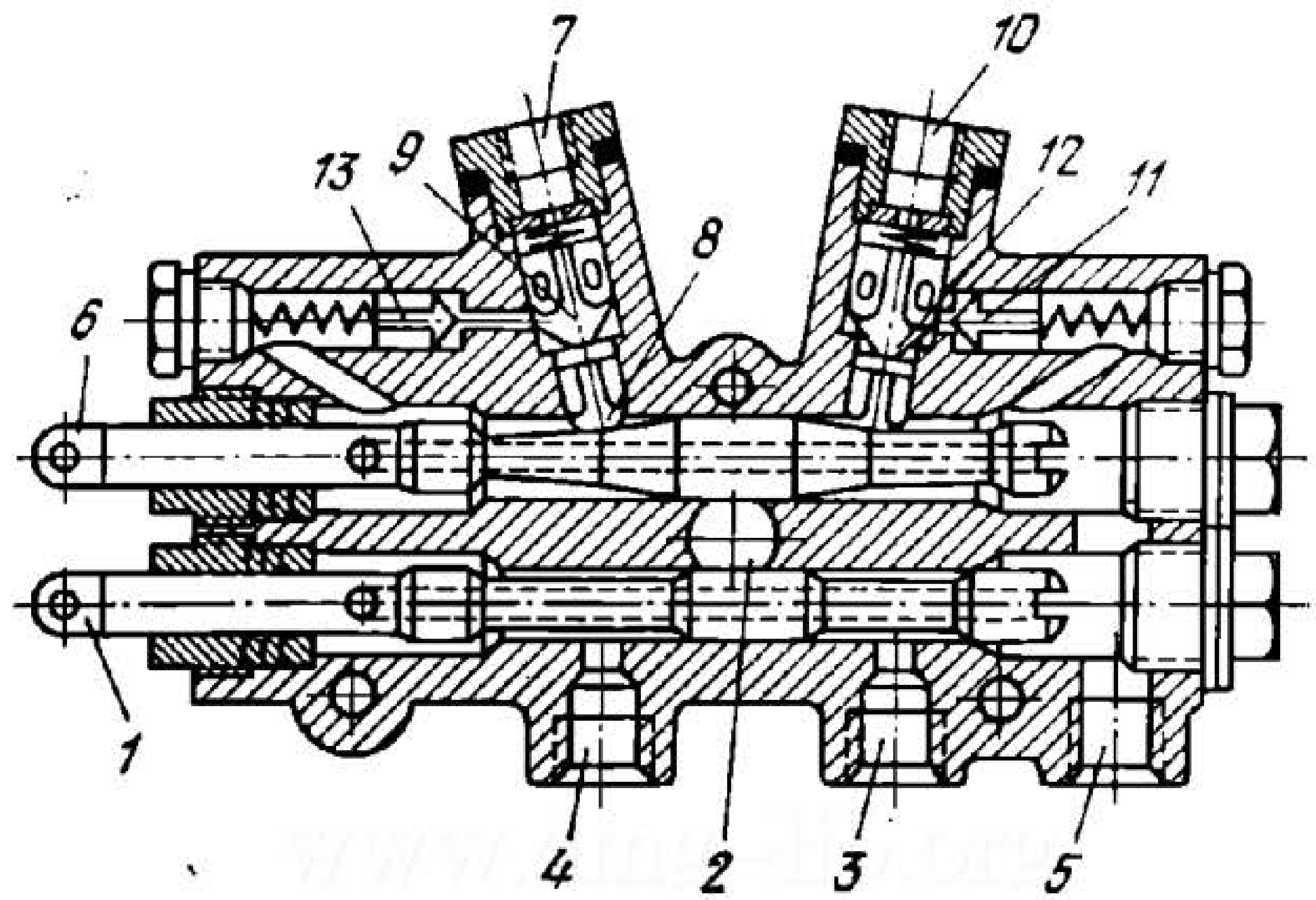


Fluid flowing from port *a* to port *b* passes through annular slit *c* of the first flow-control unit and through throttling orifice *d* of the second unit. Piston *1* is subject at its lower end to the pressure of the fluid after first flow control, and above, at its upper end, to the pressure of the fluid after second flow control and to the action of helical spring *2*. When the pressure in port *a* increases above a definite value, piston *1* moves upward and reduces the clear opening at *c*. Since the discharge through throttling orifice *d* continues, the pressure below piston *1* drops, piston *1* moves downward and the clear opening increases again. In this way, fluctuations in flow of the fluid passing through the flow-control valve, due to fluctuations in pressure preceding the valve, are reduced.

3656	FOUR-WAY TWO-POSITION SPOOL-TYPE DIRECTIONAL VALVE MECHANISM	SHP FC

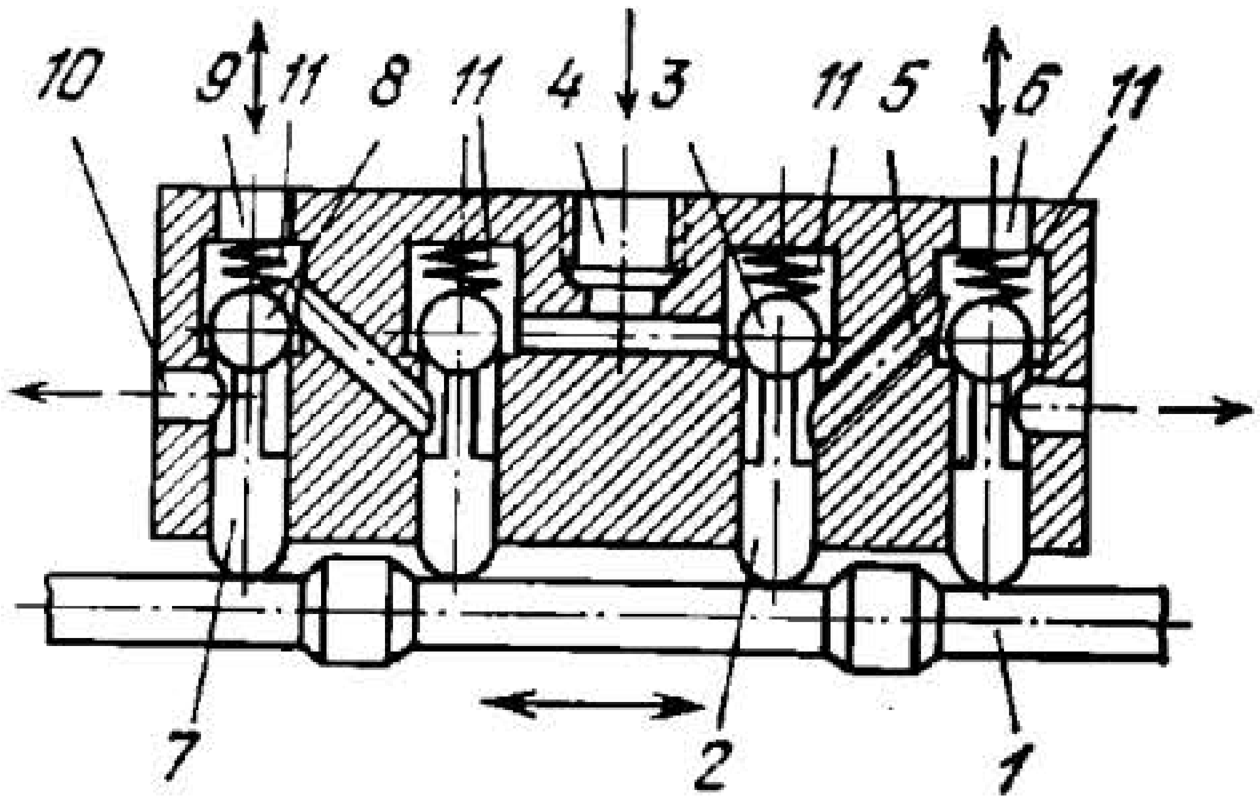


With its lands *a*, valve spool *1* divides the inner space into two chambers: chamber *b*, connected by port *d* to the high-pressure system main, and chamber *c*, connected by port *e* to the low-pressure system main. When spool *1* is in its extreme right-hand position (as shown), port *g* is connected to the high-pressure main and port *f* to the low-pressure main. When spool *1* is shifted to its extreme left-hand position, port *f* is connected to the high-pressure main and port *g* to the low-pressure main. The spool is shifted to the left by pressing roller *h*, and to the right by helical spring *2*.



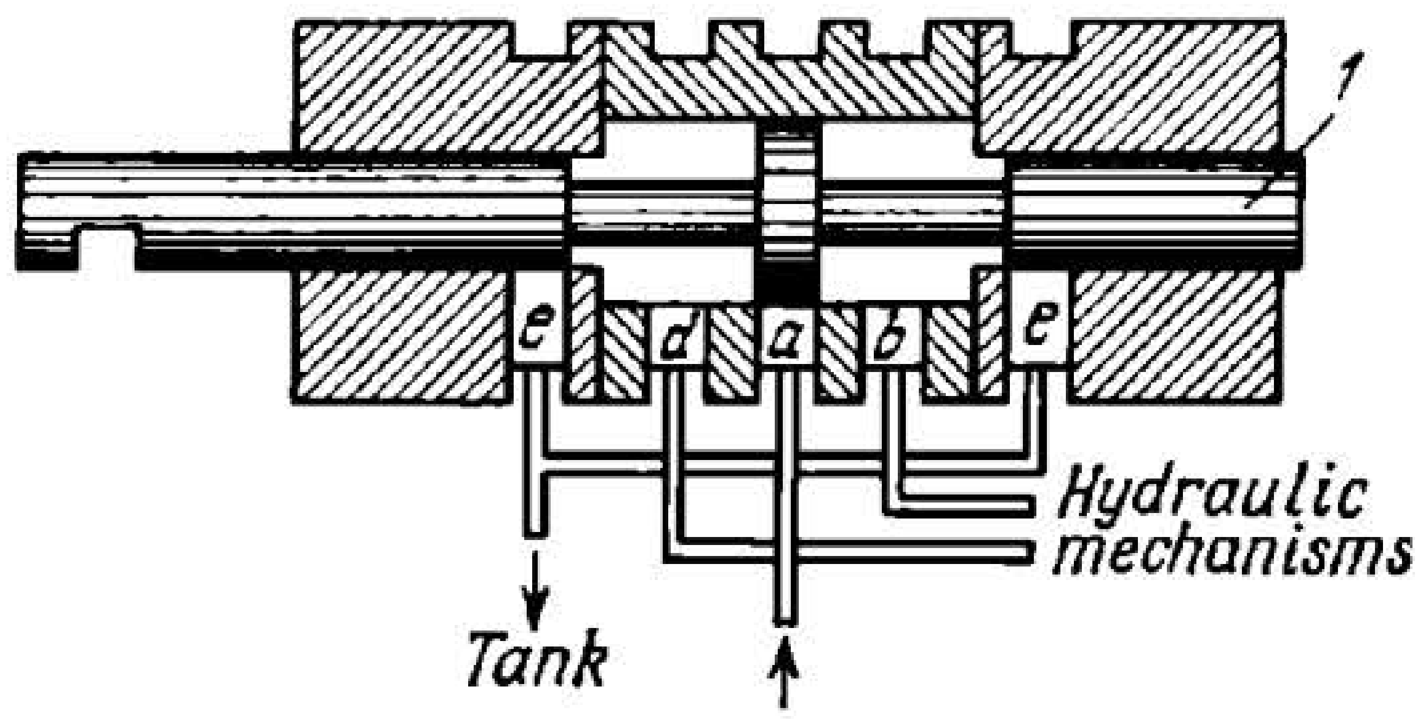
To accomplish a certain required operation, spool *1* is shifted to the left. At this, fluid delivered by the pump along channel *2* is admitted to port *3* and further to the working main. Return flow passes through port *4* and an axial channel of spool *1* to port *5* and into the tank. For the next operation, spool *1* is shifted to the right, admitting fluid from channel *2* into port *4*. Return flow passes through port *3* to port *5* and into the tank. When spool *6* is shifted to the right, fluid from channel *2* passes along side grooves of pusher *8*, opening check valve *9*, and is admitted through port 7 to the working main. Fluid is discharged from the exhaust end of the power cylinder through port *10*, check valve *11* and internal passages of the valve body to port *5* and the tank. For the opposite operation, spool *6* is shifted to the left. Then, fluid from channel *2* opens check valve *12*, and is admitted through port *10* to the working main. Fluid discharged from the exhaust ends passes through port 7, check valve *13* and the axial channel of spool *6* to port *5* and the tank.

3658	CAM-OPERATED BALL-TYPE DIRECTIONAL VALVE MECHANISM	SHP FC



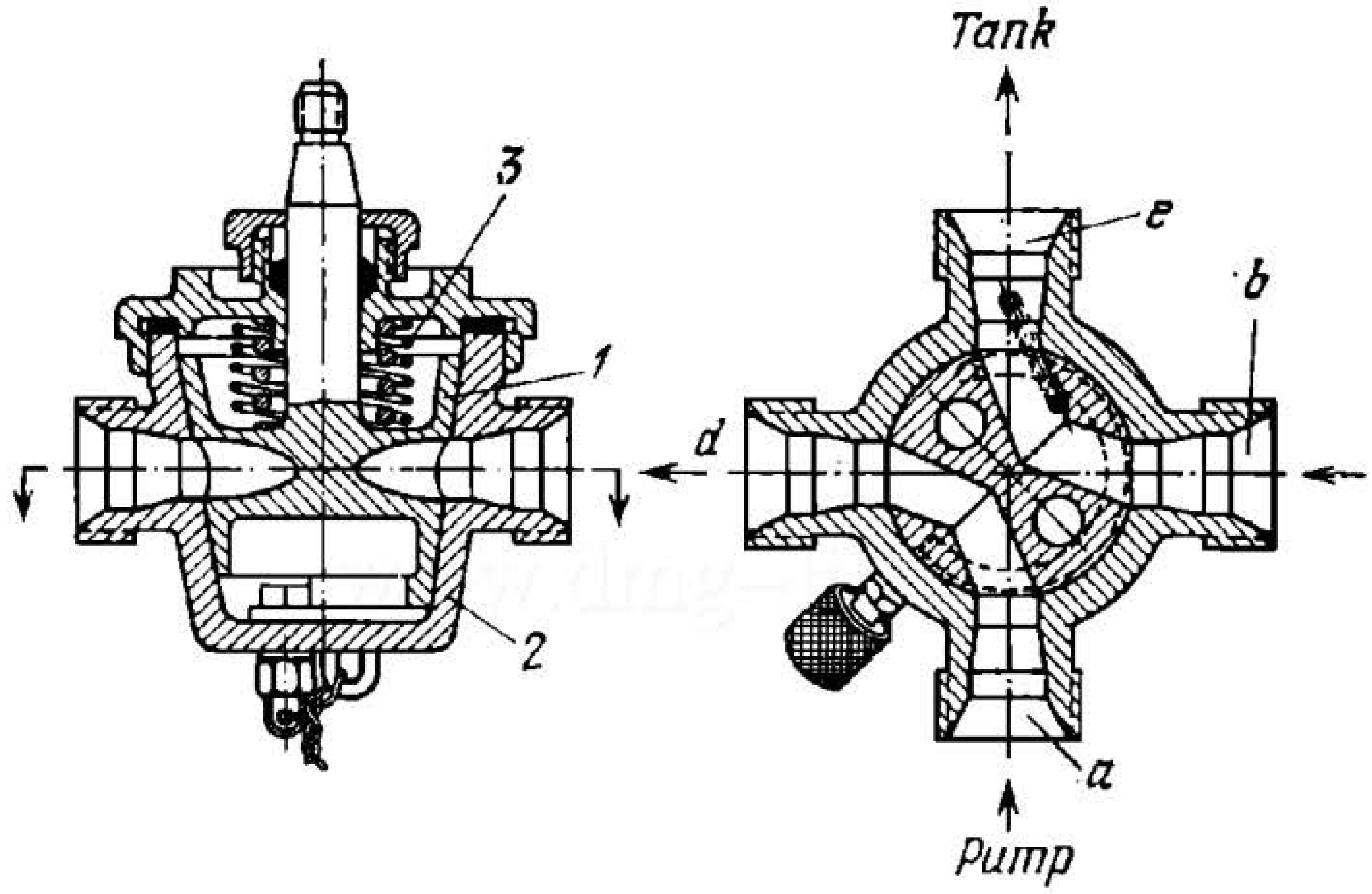
When cam rod *1* is shifted to the left, pusher *2* lifts ball valve *3* and admits fluid from port *4* to channel *5* and port *6*. At the same time, pusher *7* lifts ball valve *8* and admits fluid from port *9* to port *10*. When cam rod *1* is shifted to the right, similar action is obtained with the second pair of ball valves. The balls of all four valves are held down by helical springs *11*.

3659	SPOOL-TYPE DIRECTIONAL VALVE MECHANISM	SHP FC



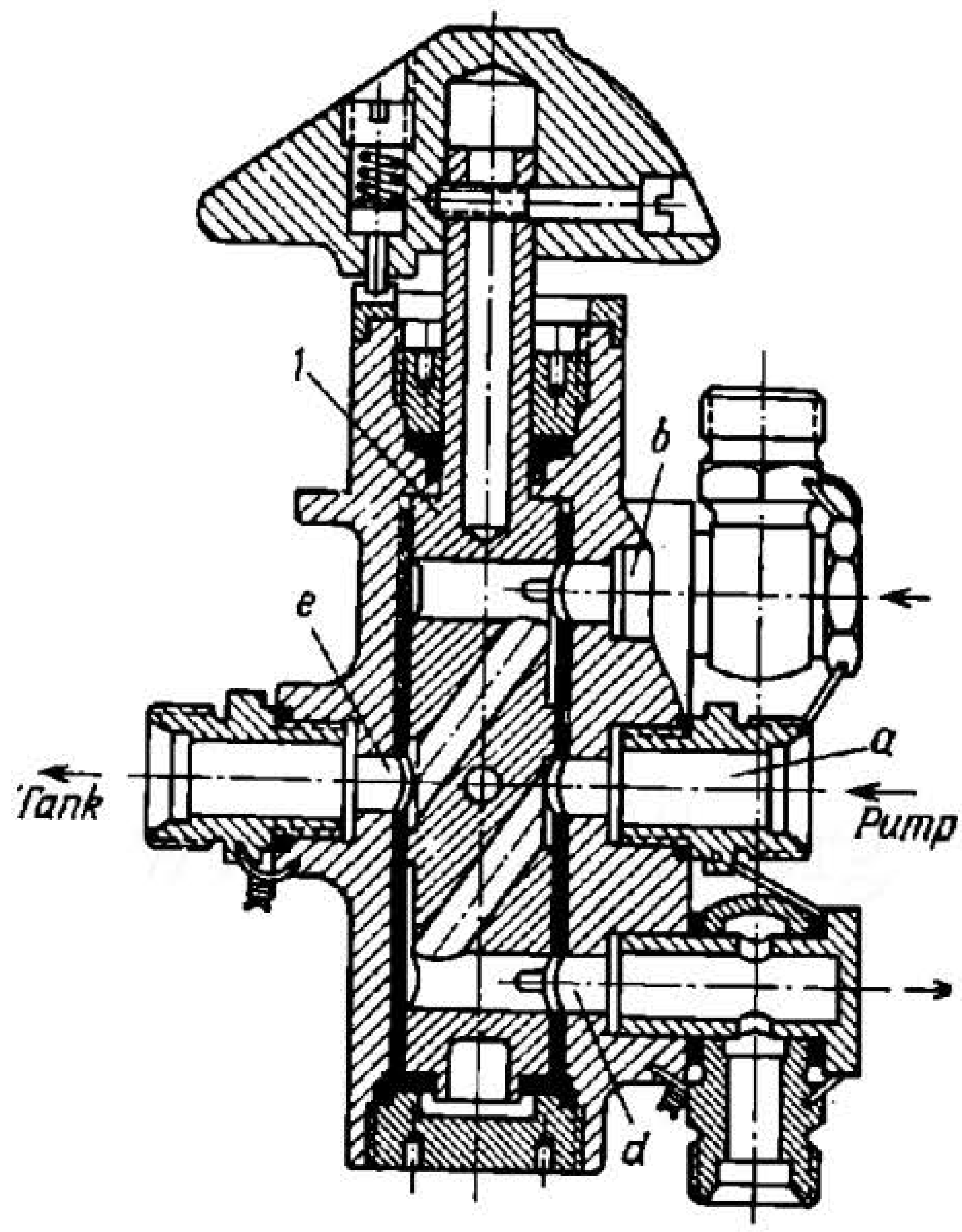
When spool *1* is shifted to the right, fluid under pressure, delivered to port *a*, is admitted through port *d* to the working end of the power cylinder. By means of ports *b* and *e*, the exhaust end of this cylinder is connected to the tank. When spool *1* is shifted to the left, port *a* is connected to port *b*, and port *d* to port *e*.

3660 | **ROTARY DIRECTIONAL VALVE MECHANISM** | SHP FC



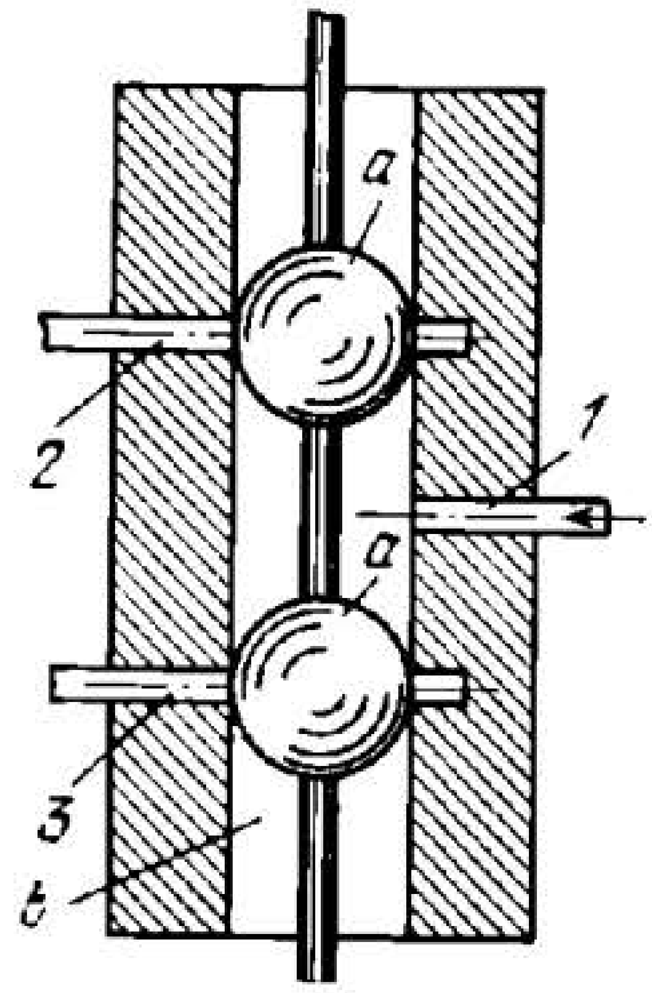
Rotary member *1* of the valve is forced into its seat in body *2* by helical springs *3* and has four passages and ports. In the position shown, the pump is connected through ports *a* and *d* to the working end of the power cylinder, and the tank through ports *b* and *e* to the low-pressure line. If member *1* is turned through 90°, the pump is connected through ports *a* and *b* to the high-pressure line and through ports *d* and *e* to the low-pressure line.

3661	COMPLEX ROTARY DIRECTIONAL VALVE MECHANISM	SHP FC



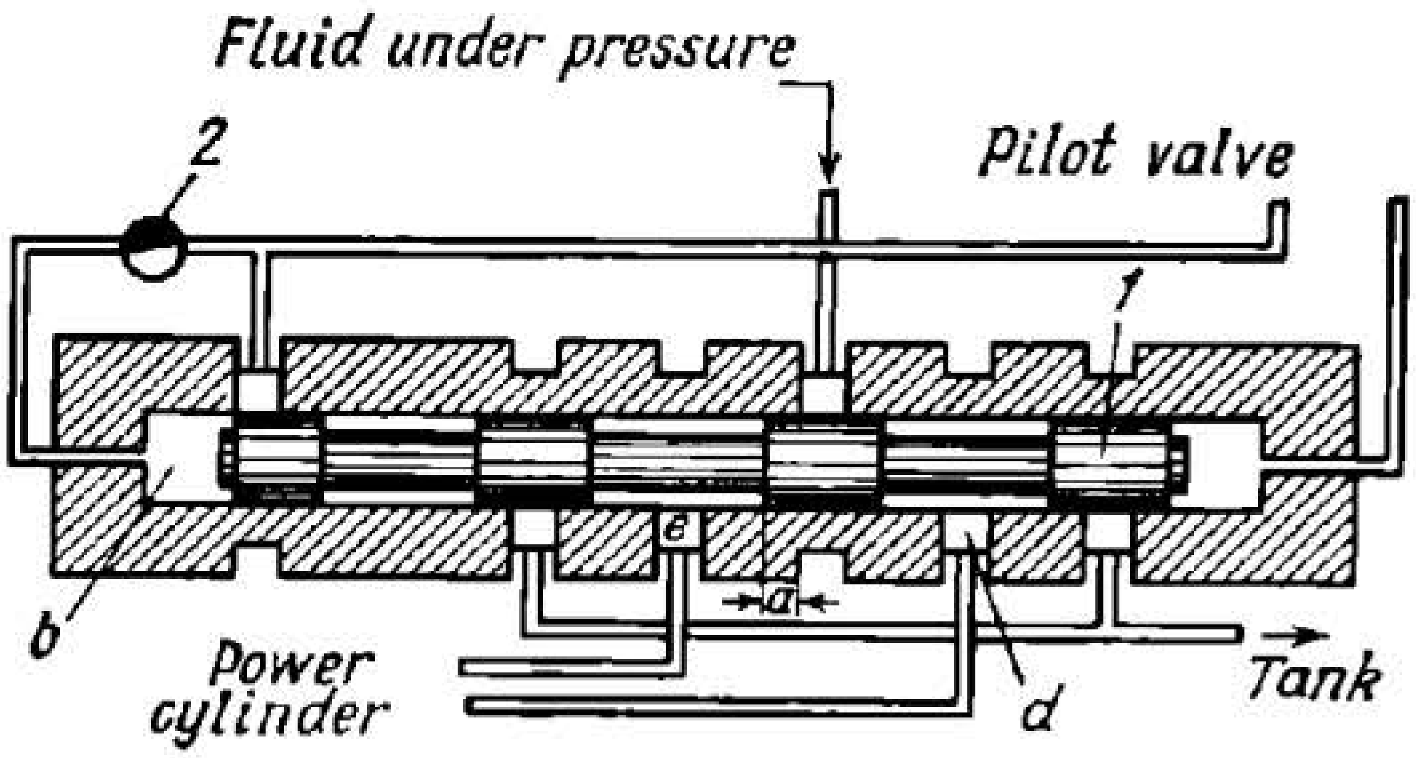
Rotary member *1* of the valve has five through passages: three perpendicular to the axis of the member and two inclined passages which connect the passages at the ends with the middle ports. Port *a* is connected to the pump which delivers fluid under pressure. Ports *d* and *b* are connected to the ends of the power cylinder, and port *e* to the tank. In the position shown, the pump delivers fluid through ports *a* and *d* to the working end of the cylinder. Fluid from the exhaust end of the cylinder is discharged through ports *b* and *e* to the tank. If valve member *1* is turned 180°, the pump is connected through ports *a* and *b* to the high-pressure line, and the tank through ports *d* and *e* to the low-pressure line.

3662	PNEUMATIC FLOW- AND DIRECTIONAL-CONTROL VALVE MECHANISM	SHP FC



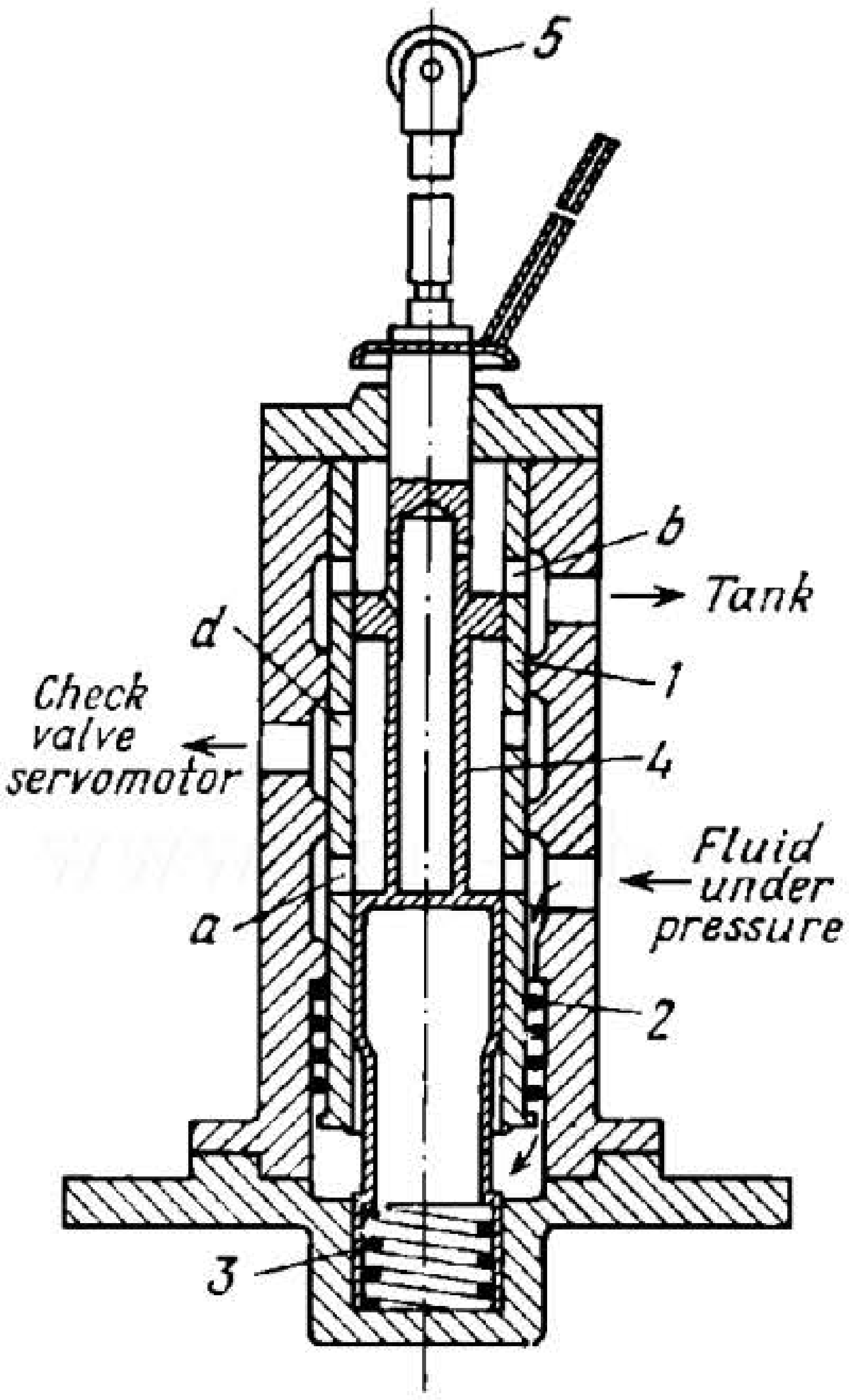
Compressed air is admitted through port *1* into the valve body and passes out into the atmosphere through the clearance between balls *a* and the valve body, the balls being somewhat less in diameter than bore *b* of the body. Depending upon the position of the balls, linked rigidly together, with respect to ports *2* and *3*, definite pressures are set up in these ports.

3663	PILOT-OPERATED SPOOL-TYPE DIRECTIONAL VAVLE MECHANISM	SHP FCj



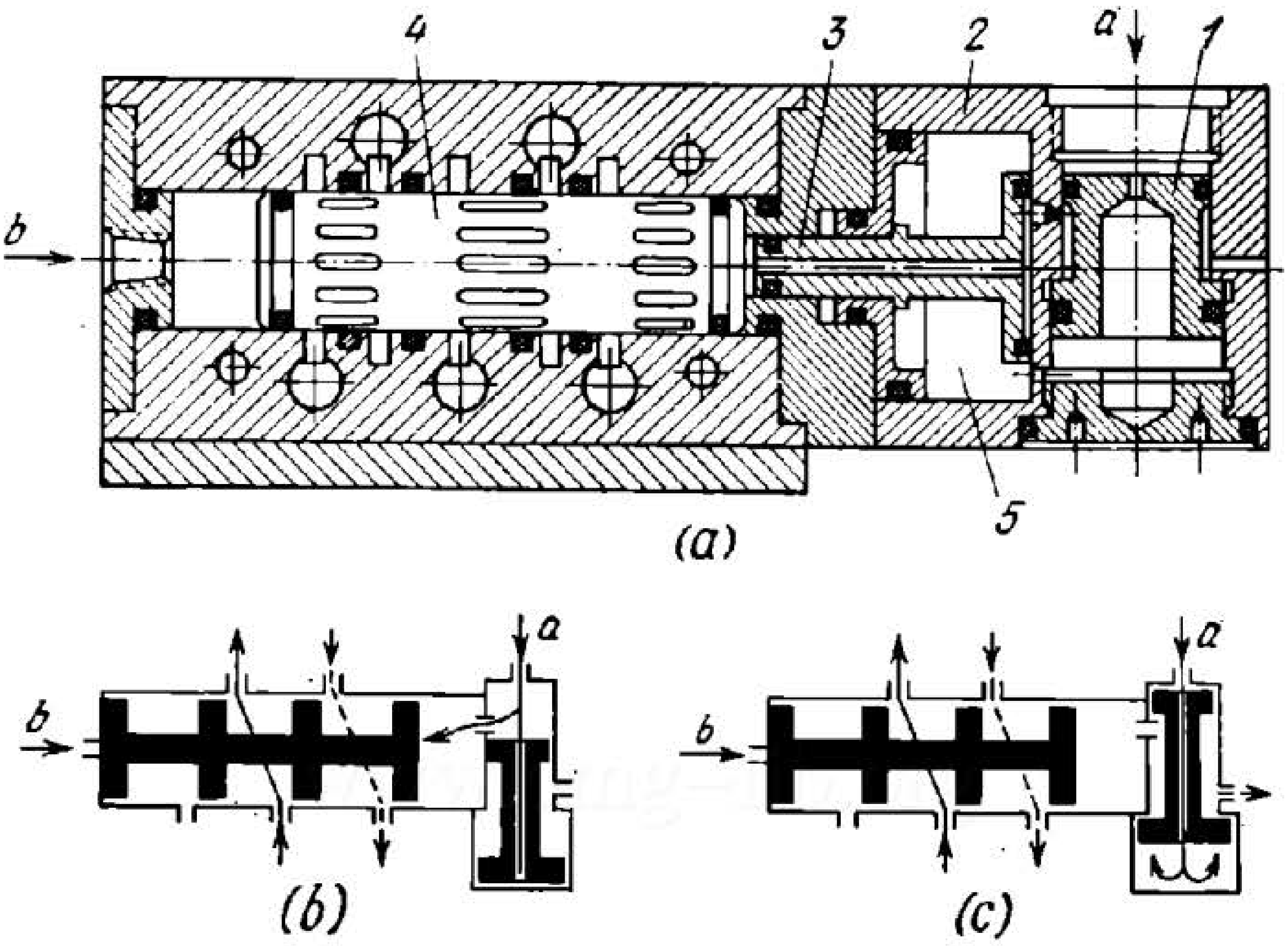
When fluid under pressure is delivered from the pilot valve to the right end chamber of the directional valve, spool *1* of the valve is shifted to the left, shutting off fluid delivery through port *e* to the power cylinder. Owing to overlap *a*, the machine tool table dwells in its extreme position. As the fluid flows out of the left end chamber *b* of the directional valve, it passes through flow-control valve *2*. This slowly increases the amount of fluid deliveredj to the power cylinder through port *d* and, as a result, the speed of the table accelerates smoothly in the return stroke.

3664	SPOOL-TYPE DIRECTIONAL VALVE MECHANISM FOR A TURBINE	SHP FC



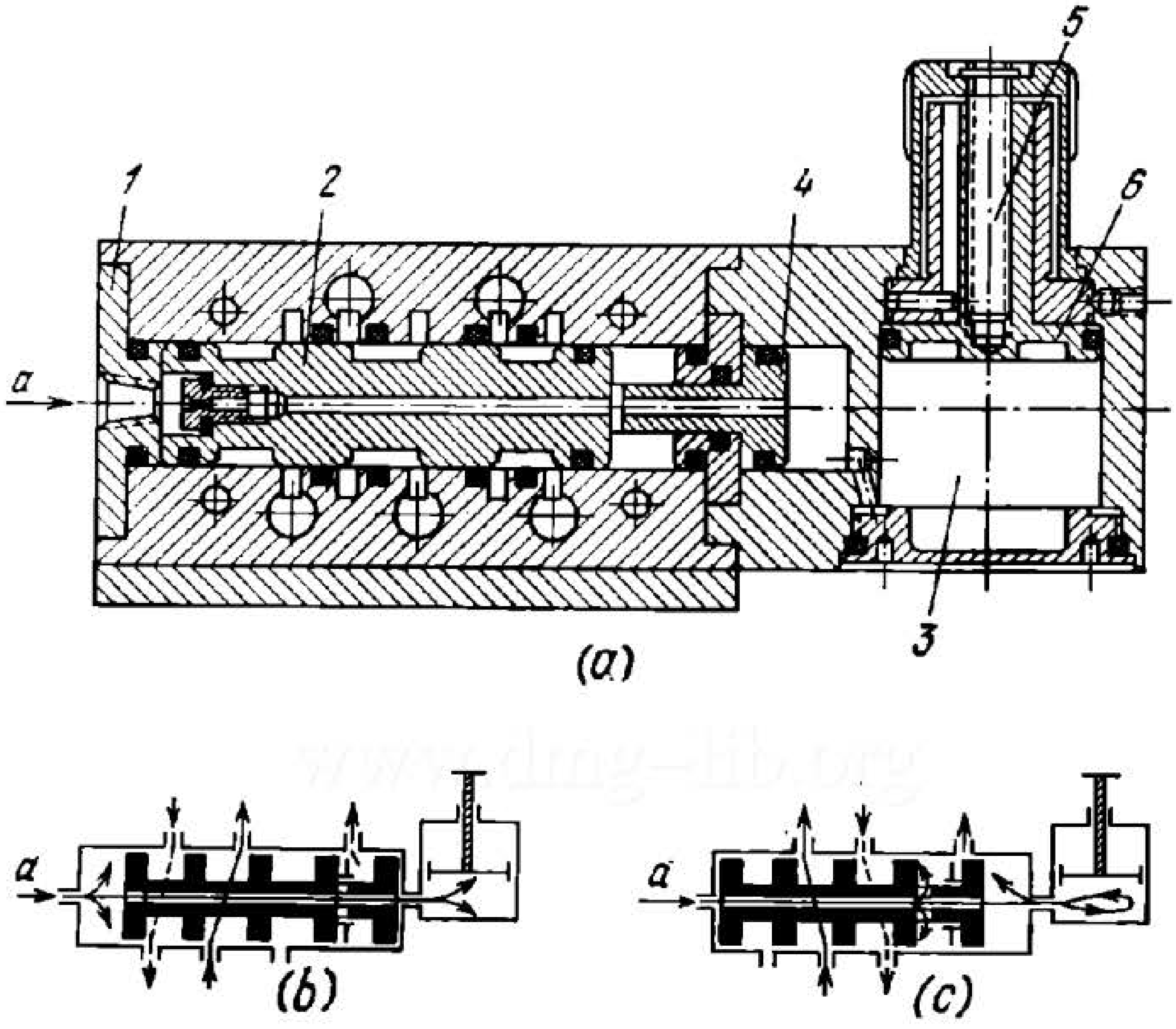
When the turbine is started, the pressure of the fluid increases and sleeve *1* is shifted upward, compressing helical spring *2* and occupying the position shown. At this, spool *4* admits fluid under pressure through ports *a* and *d* to the servomotor of the check valve. Upon a drop in load and when roller *5* is released, spool *4* is raised to its upper extreme position by helical spring *3*, cutting off the flow of fluid under pressure to the servomotor which is connected through port *b* to the tank.

3665	PILOT-OPERATED FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



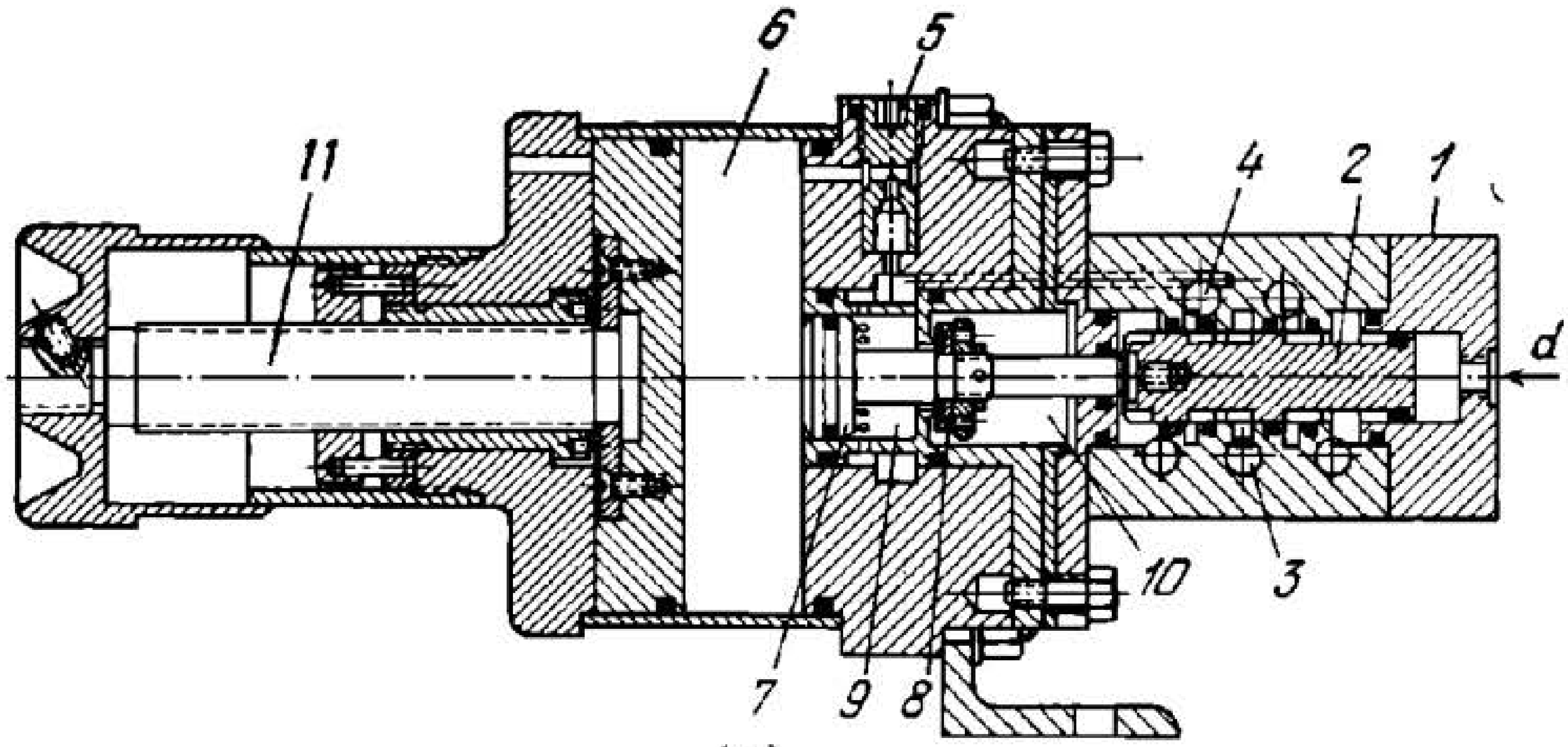
Incoming pilot air at port *a* (Fig. *a*) shifts plunger *1* downward and compressed air is admitted through the port in intermediate cover *2* and the central channel in sleeve *3* to the right end of the main valve to shuttle spool *4* to the left. At the same time, air passes through a hole in plunger *1*, to the space under the plunger, and fills space *5*. Since the lower area of plunger *1* is greater than its upper area, the plunger is returned to its initial (upper) position after a certain time delay. Thus the right end of spool *4* is connected to the atmosphere notwithstanding the pilot air supplied through port *a*. After this, spool *4* remains in its shuttled position (at the left) and can be shuttled back again to the right by admitting pilot air at port *b* without shutting off the pilot air at port *a*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3666	PILOT-OPERATED FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC

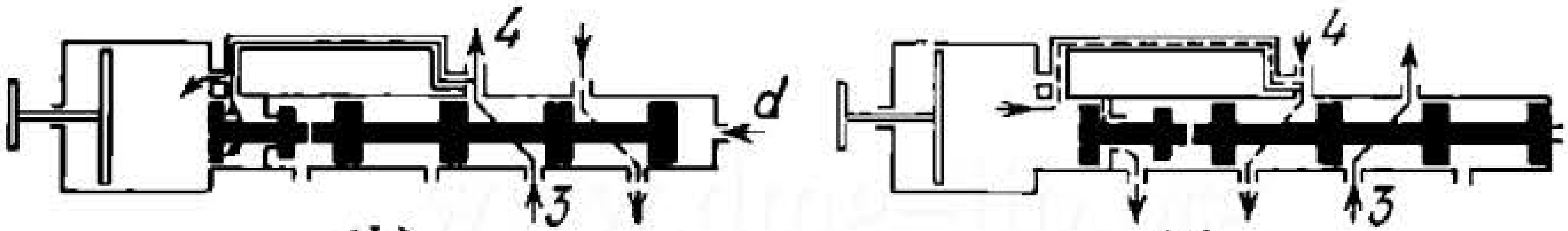


When compressed (pilot) air is admitted through threaded port *a* in cover *1* (Fig. *a*), spool *2* is shuttled to the right. At the same time air passes through a metering orifice in a connection and central channel in spool *2* and begins to fill space *3*. As the space is filled, the pressure in it rises. Since the effective area of the spool at its right end is twice that at its left end, owing to the provision of auxiliary plunger *4*, after a certain time delay plunger *4* shuttles spool *2* to the left, back to its initial position. The length of the time delay depends upon the volume of space *3* and can be regulated by changing this volume. This is done by turning screw *5* which adjusts piston *6* vertically. The directional valve is operated after the arrival of incoming pilot air at port *a* and, after a time delay, is returned to its initial position without shutting off the pilot air at port *a*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3667	PILOT-OPERATED FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



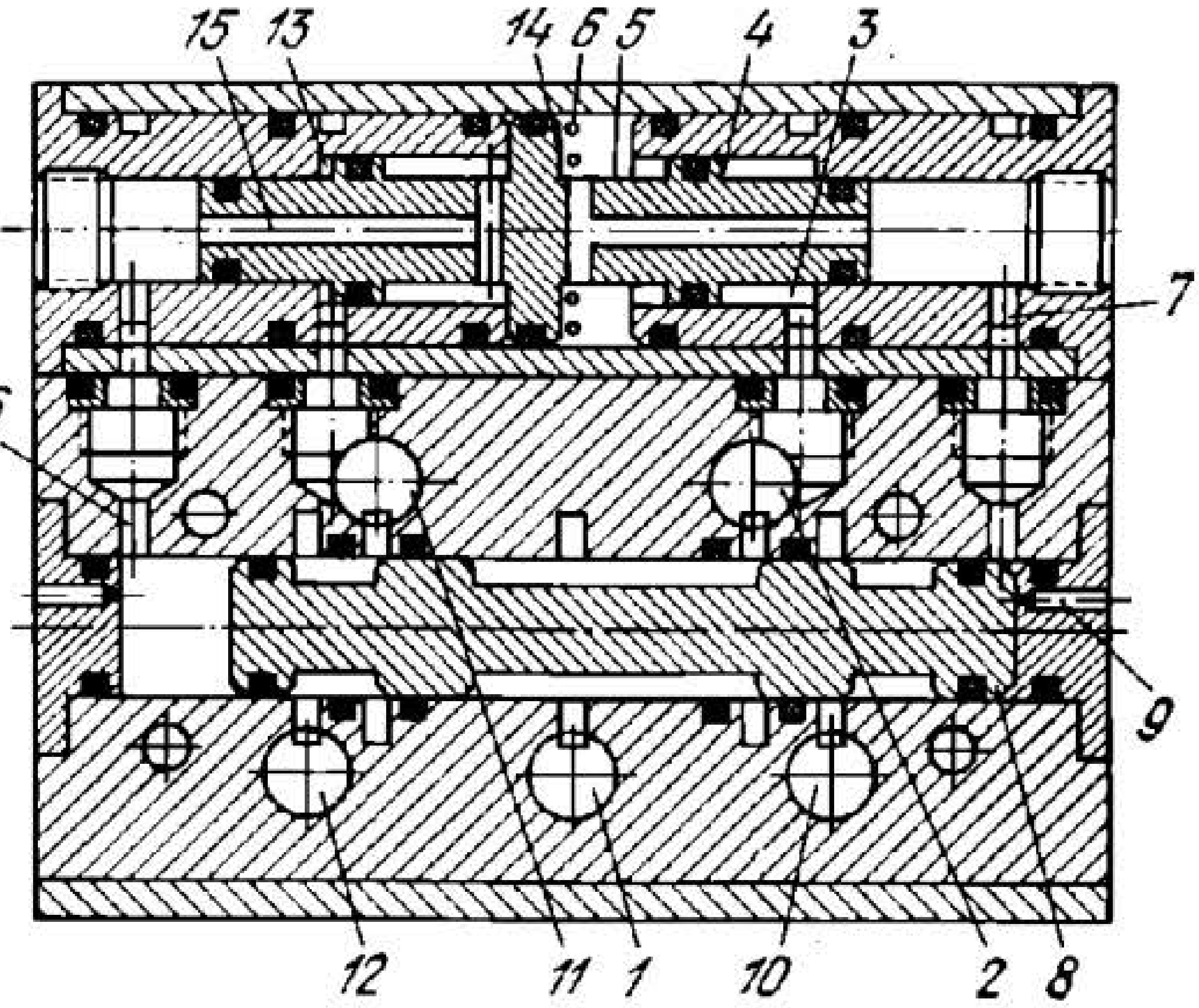
(a)



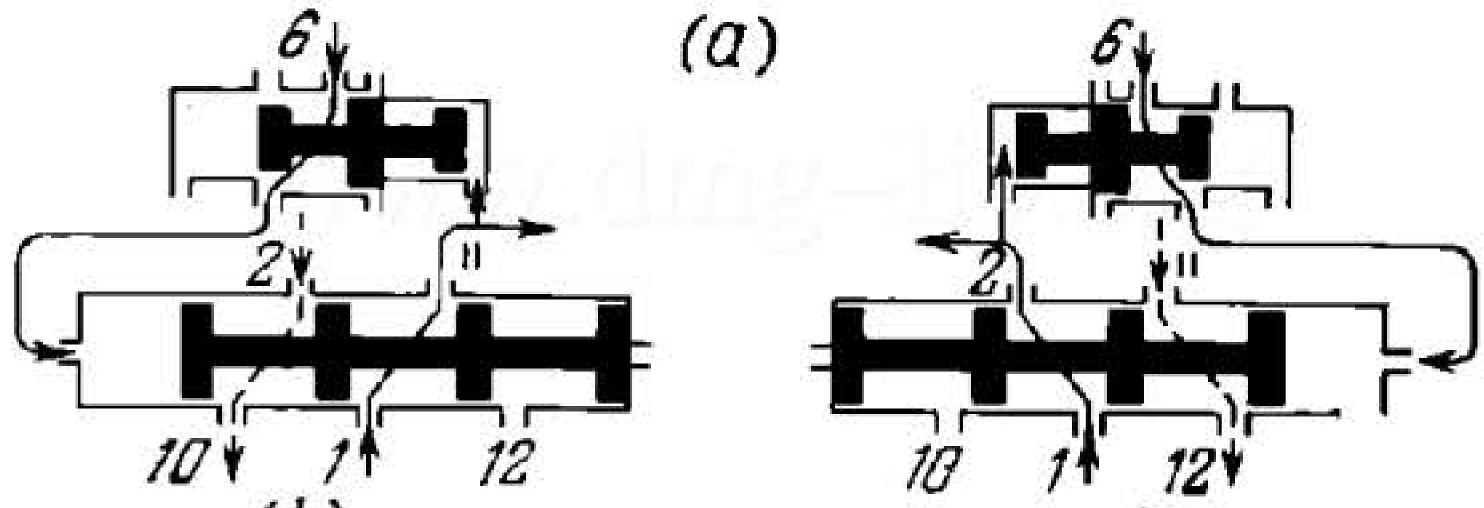
(b) (c)

When compressed (pilot) air is admitted through threaded port *d* in cover *1*, spool *2* is shuttled to the left (as shown). After this, the supply of compressed air is shut off and port *d* is connected to the atmosphere. Through a pusher, spool 2 shifts auxiliary plunger 7 so that valve member *8* closes the passage from space *9* to space *10*, which is constantly connected to the atmosphere. After the spool is shuttled, air from the main (port *3*) passes through port *4* to the operating device. At the same time, air from port *4* passes through internal channels of the valve body into space *9* and through the metering orifice in connection *5* into space *6*. Since the effective area at the left end of plunger *7* is greater than that at its right end, after a certain time delay, required to fill space *6*, plunger *7* begins to shift to the right. During the initial part of its motion, it opens valve member *8* and, consequently, space *9* is connected to the atmosphere. As a result, the motion of plunger *7* is accelerated and, by means of the pusher, it shuttles spool *2* to its initial position (at the right). Thus, as a pulse signal (pilot air) arrives, it operates the directional valve which, after a time delay, is returned to its initial position. The length of the time delay can be regulated by changing the volume of space *6*. This is done by turning screw *11*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3668	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM WITH A THREE-WAY PILOT VALVE	SHP FC



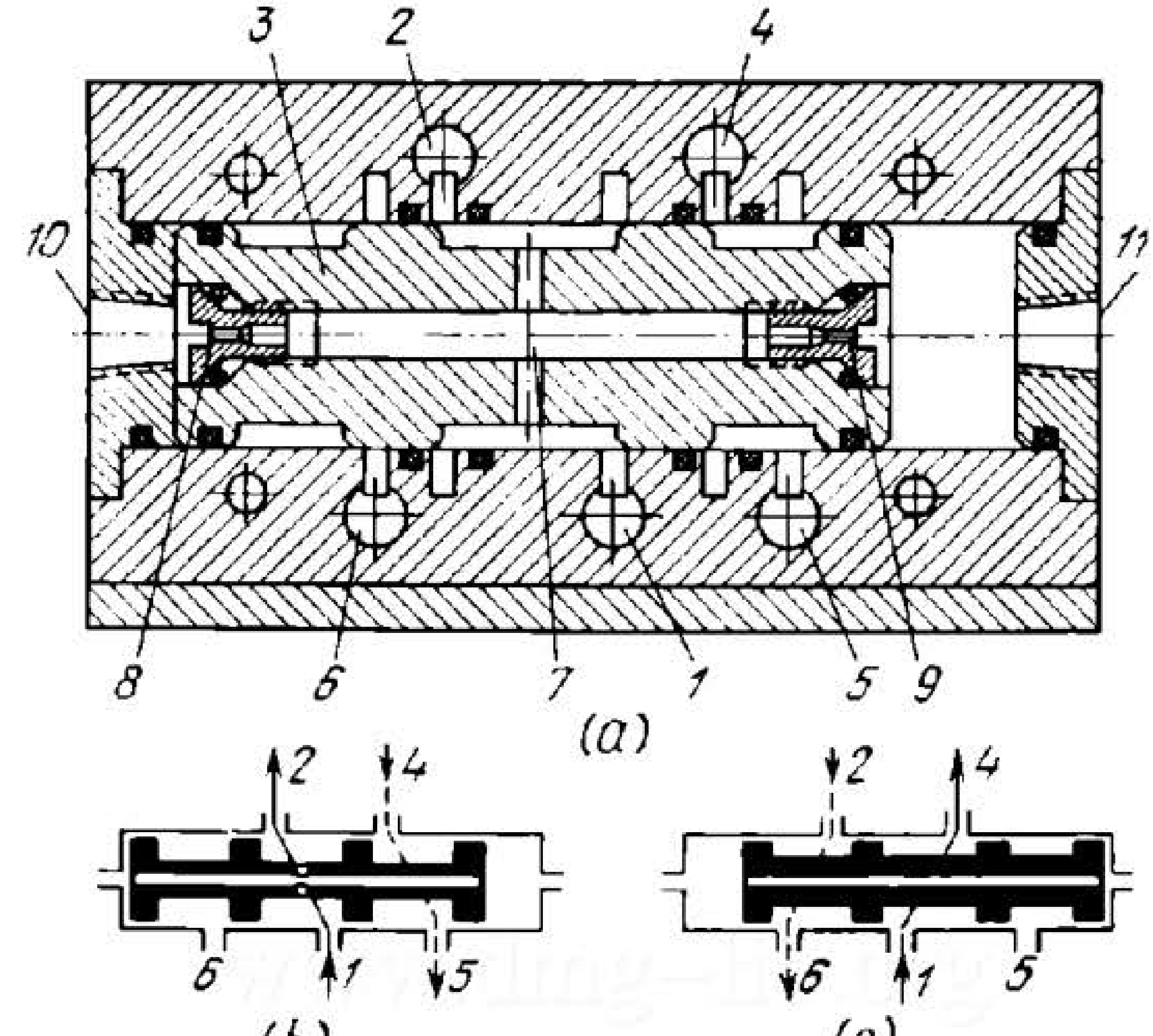
(a)



(b) (c)

Air is supplied from the main to port *1* and further through a groove in spool *8* and channels in the body into space *3*. Acting on shoulder *4* of spool *5* it shuttles this spool to the position shown in Fig. *a*. Ports *6* are for admitting air into the directional valve with the direction of flow controlled by the pilot valve. With spool *5* in the position shown, air is admitted through ports *6* and passes through the internal channels of spool *5* and port *7* to the right end of directional valve spool *8*. This end space is connected to the atmosphere through small-diameter orifice *9*. But since incoming air through port *7* exceeds the discharge through orifice *9*, the pressure in the right end space rises. The left end space of spool *8* is connected to the atmosphere through a small-diameter orifice. Owing to the difference in pressure at its ends, spool *8* is shuttled to the left. This connects port *2* to port *10*, which leads to the atmosphere, and, consequently, the pressure in space *3* drops. Port *11* is connected to port *1* and the compressed air acts on shoulder *13*, tending to shuttle spool *5* to the right. But, at this time, spool *5* is still held by compressed air entering through ports *6* and, since the area of shoulder *14* is larger than that of shoulder *13*, spool *5* remains in the position shown. When the pilot valve is released, ports *6* are connected to the atmosphere and pressure shuttles spool *5* to the right. The next time the pilot valve is operated, air from ports *6* passes through channel *15* and port *16* to the left end space of spool *8*, shuttling this spool to the right to the position shown in Fig. *a*. When the pilot valve is released again, the pressure on shoulder *4* shuttles pilot valve spool *5* back to the position shown in Fig. *a*. Thus, spool *8* is shuttled upon each pulse of pilot air. The principle of the valve is shown schematically in Figs. *b* and *c*.

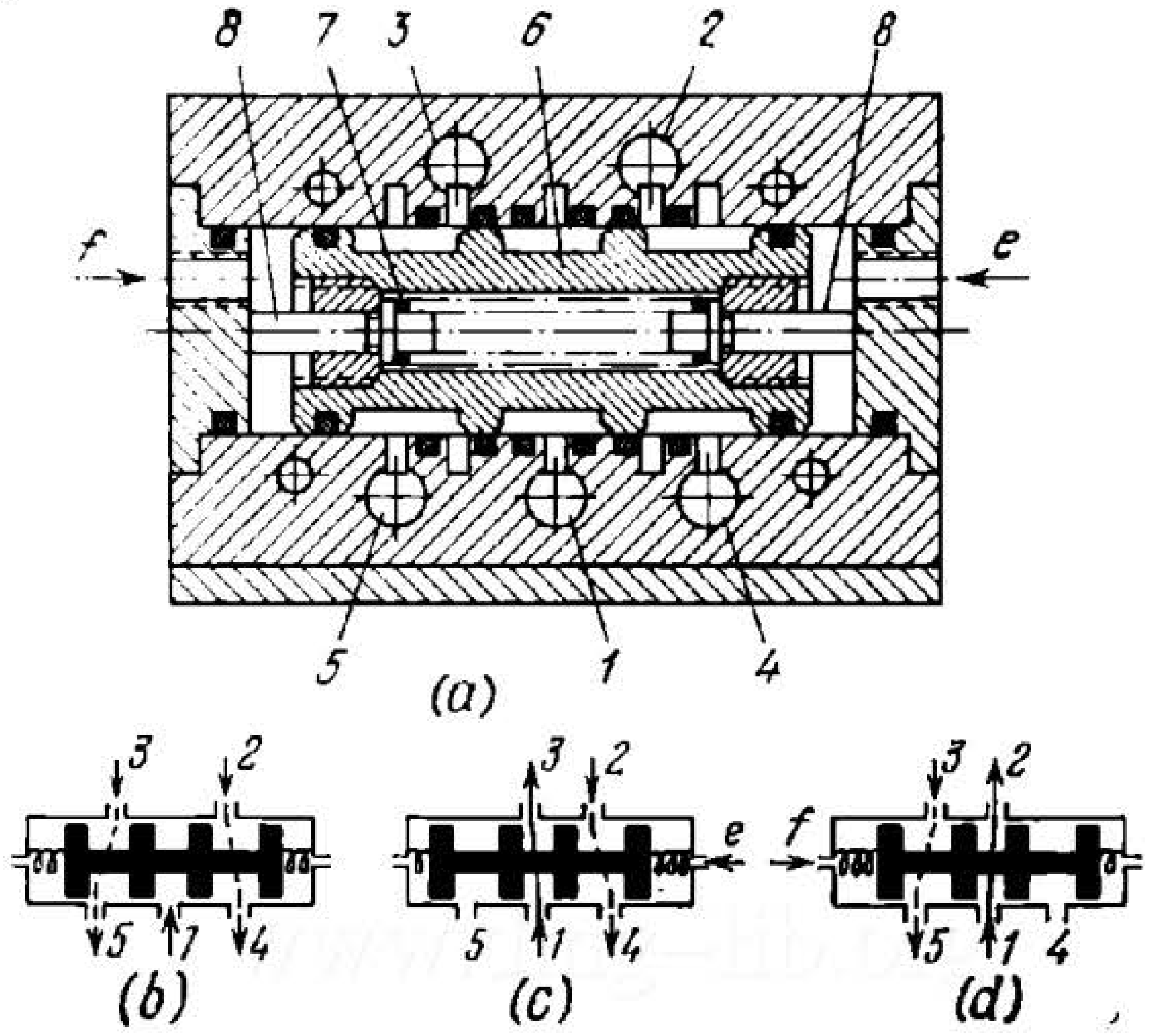
3669	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a) (b) (c)

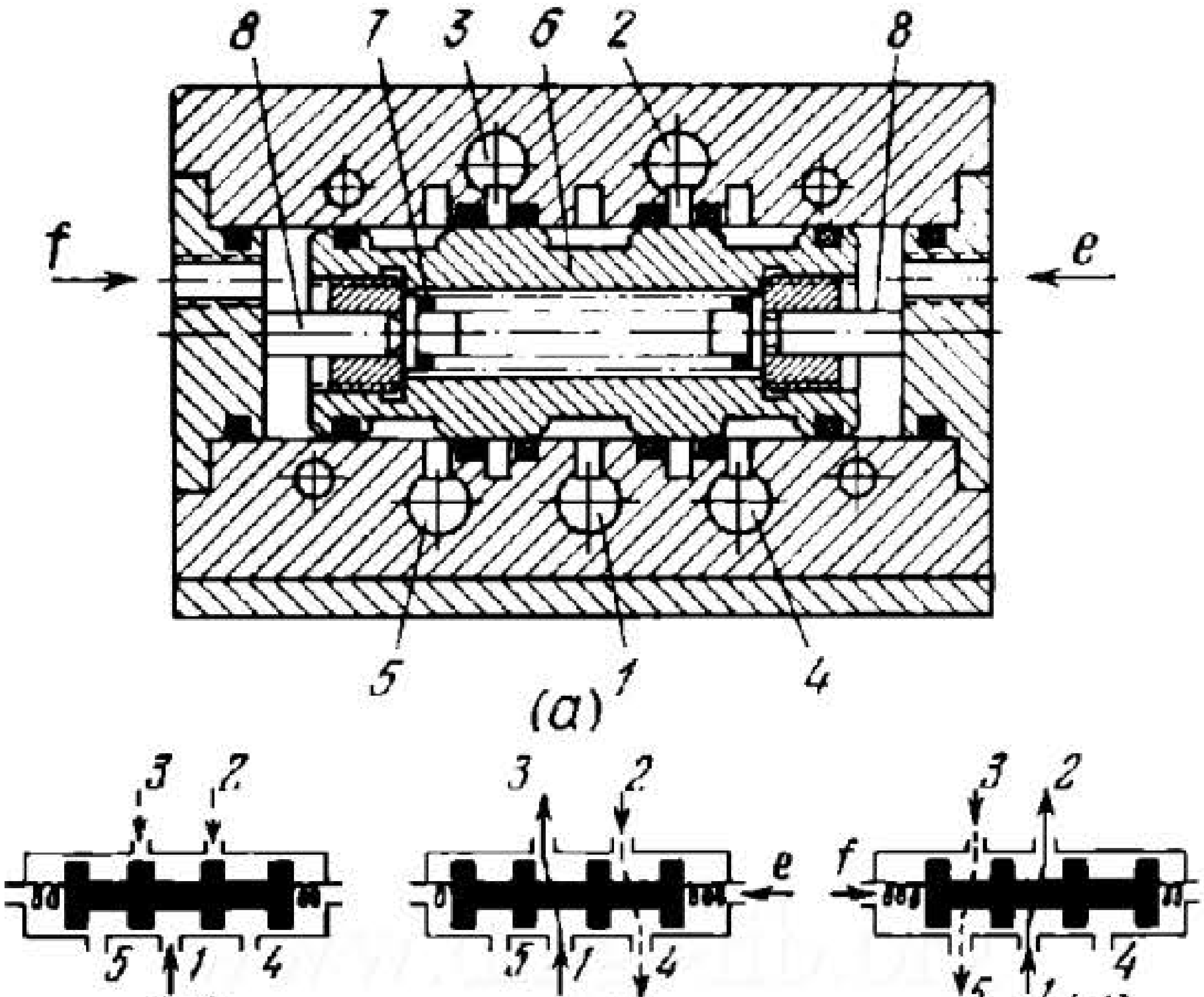
Air is supplied from the main through port *1* and, in the position of spool *3* shown in Fig. *a*, passes through port *2*. Port *4* is connected to port *5*, which leads to the atmosphere. At the same time, compressed air passes through central channel *7* and further through metering orifices *8* and *9* to the left and right end spaces of spool *3*. Ports *10* and *11* are connected by pipelines to normally closed two-way pilot valves. Therefore the pressure is equal at the two ends of the spool which, due to friction, remains in the initial position. If port *11* is connected through a two-way pilot valve to the atmosphere and if the incoming air through orifice *9* is less than the discharge through the connecting pipeline and pilot valve, then the pressure in the right end space drops almost to atmospheric pressure. The pressure in the left end space remains constant and, owing to the pressure difference, spool *3* is shuttled to the right. When port *10* is connected to the atmosphere and port *11* is closed off, spool *3* returns to its initial position. The advantageous feature of the directional valve is that it operates with a two-way small-size pilot valve of simplest design which is not connected to the compressed air main. The directional valve operates properly only when the pipelines are of definite lengths. The principle of the valve is shown schematically in Figs. *b* and *c*.

3670	FIVE-WAY THREE-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



When there is no incoming pilot air through ports *f* and *e*, i.e. when these ports and the end spaces of spool *6* are connected to the atmosphere, spring *7* slides out two pins *8* (Fig. *a*). The length the pins protrude from the ends of spool *6* is limited and adjusted by special nuts and, consequently, spool *6* is located accurately in the central position. In this position, port *1*, to which compressed air from the main is delivered, is closed off and ports *2* and *3* are connected, respectively, to ports *4* and *5*, which lead to the atmosphere. Since ports *2* and *3* are connected to the ends of an operating cylinder or other device, in the given position the device is connected to the atmosphere. When pilot air is admitted through port *e*, spool *6* is shuttled to the left by the compressed air, and compressed air from port *1* is admitted into port *3* while port *2* is still connected to the atmosphere through port *4*. If port *e* is connected to the atmosphere and pilot air is admitted through port *f*, spool *6* is shuttled to the right and compressed air from port *1* is admitted into port *2* while port *3* is connected to the atmosphere through port *5*. The principle of the valve is shown schematically in Figs. *b*, *c* and *d*.

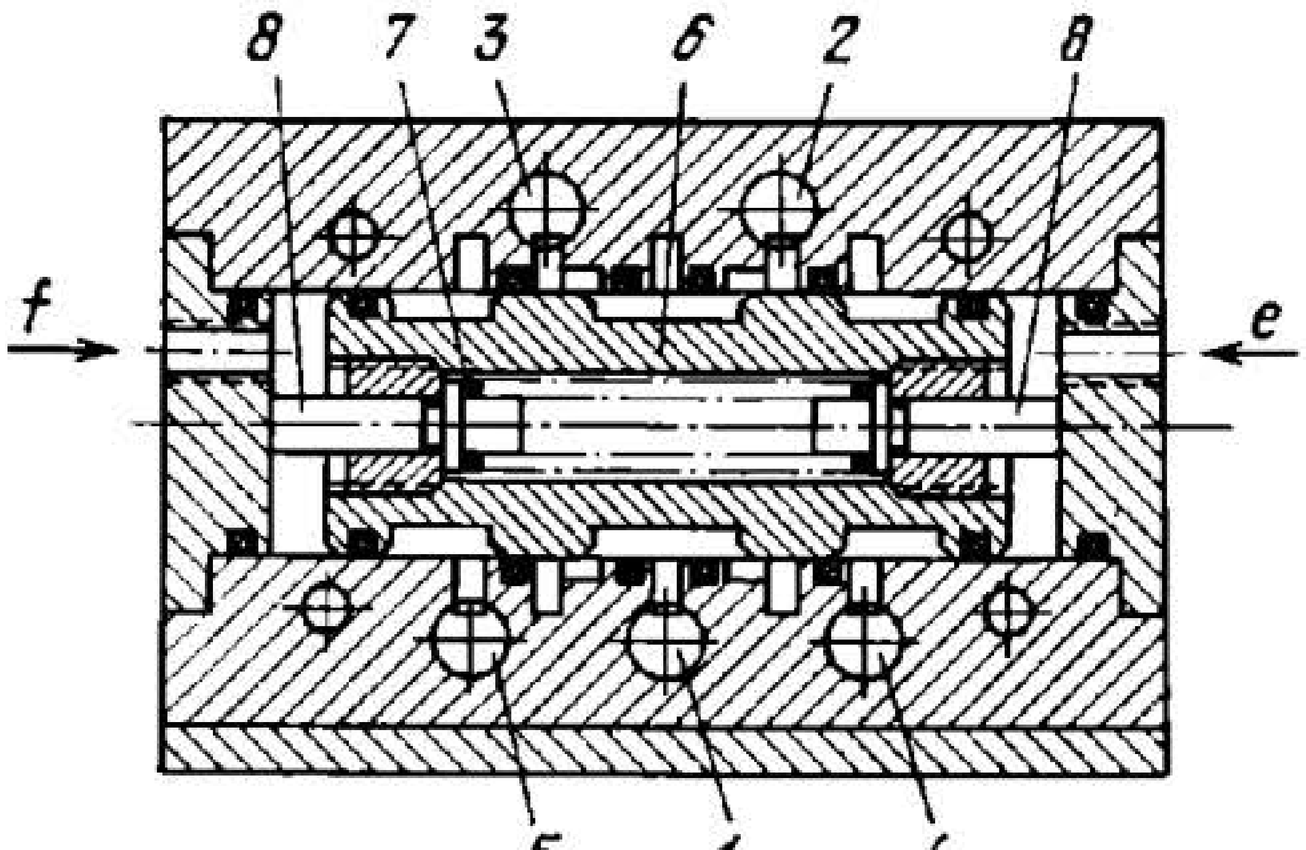
FIVE-WAY THREE-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM



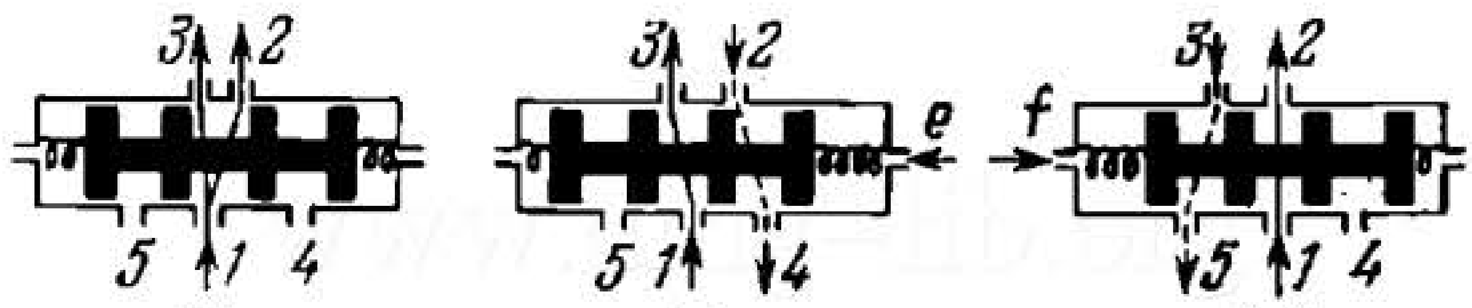
(a) (b) (c) (d)

When there is no incoming pilot air through ports *e* and *f*, i.e. when these ports and the end spaces of spool *6* are connected to the atmosphere, spring *7* slides out two pins *8* (Fig. *a*). The length the pins protrude from the ends of spool *6* is limited and adjusted by special nuts and, consequently, spool *6* is located accurately in the central position. In this position, ports *2* and *3*, connected to the ends of the operating cylinder or other device, are closed off. Port *1*, to which compressed air from the air main is delivered, is also closed off. When pilot air is admitted through port *e*, spool *6* is shuttled to the left by the compressed air. At this, port *2* is connected to port *4*, which leads to the atmosphere, and compressed air from port *1* is admitted into port *3*. If port *e* is connected to the atmosphere and pilot air is admitted through port *f*, spool *6* is shuttled to the right and port *3* is connected to the atmosphere through port *5*, while compressed air from port *1* is admitted into port *2*. The principle of the valve is shown schematically in Figs. *b*, *c* and *d*.

3672	FIVE-WAY THREE-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



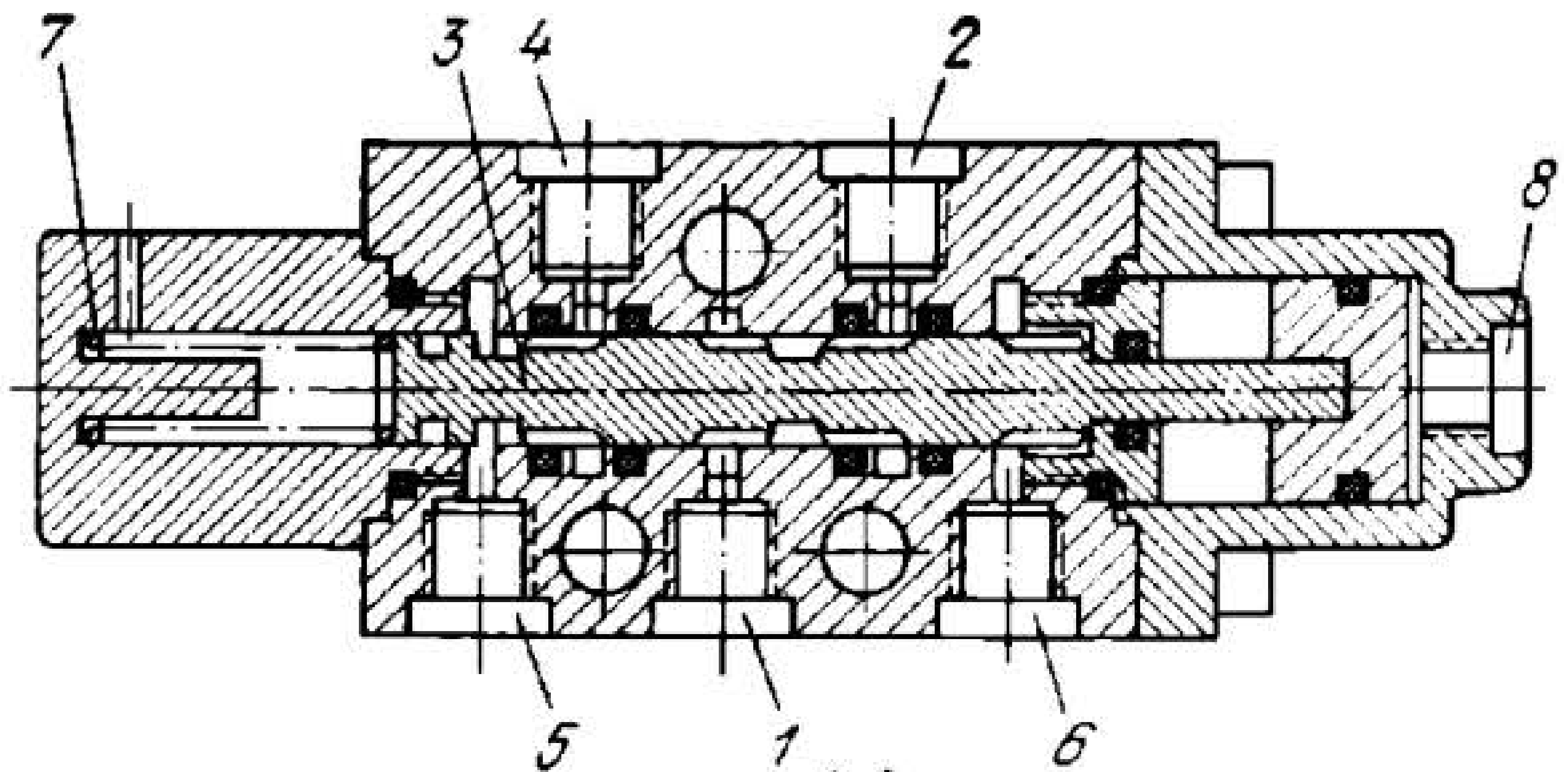
(a)



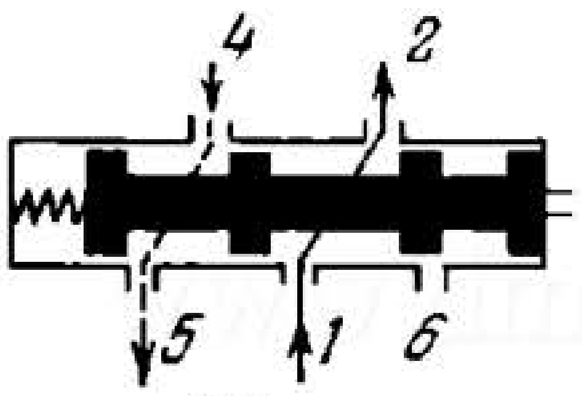
(b) (c) (d)

When there is no incoming pilot air through ports *e* and *f*, i.e. when these ports and the end spaces of spool *6* are connected to the atmosphere, spring *7* slides out two pins *8* (Fig. *a*). The length the pins protrude from the ends of spool *6* is limited and adjusted by special nuts and, consequently, spool *6* is located accurately in the central position. In this position, port *1*, to which compressed air from the main is delivered, is connected to ports *2* and *3* which, in turn, are connected to the ends of the operating cylinder or other device. Thus both ends of the operating cylinder are under pressure. When pilot air is admitted through port *e*, spool *6* is shuttled to the left by the compressed air. At this, port *2* is connected to port *4*, which leads to the atmosphere, and compressed air continues to pass from port *1* into port *3*. If port *e* is connected to the atmosphere and pilot air is admitted through port *f*, spool *6* is shuttled to the right and port *3* is connected to the atmosphere through port *5*, while compressed air from port *1* is admitted into port *2*. The principle of the valve is shown schematically in Figs. ***b***, ***c*** and ***d***.

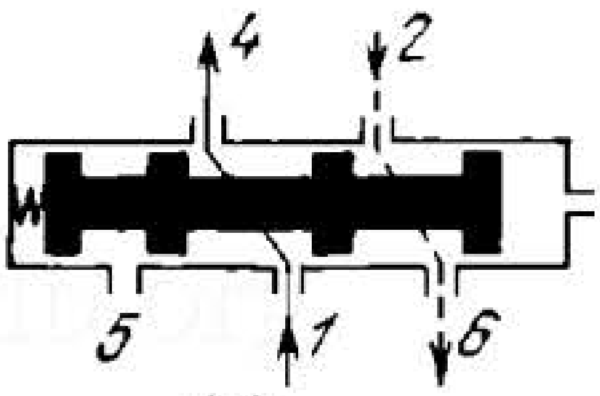
3673	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a)



(b)



(c)

Spring *7* holds spool *3* in the position shown in Fig. *a*. At this, port *1*, to which compressed air is supplied from the main, is connected to port *2*, and port *4* is connected to port *5*, which leads to the atmosphere. When pilot air is admitted through port *8*, the piston linked to spool *3* shuttles the spool to the left, overcoming the resistance of spring *7*. At this, port *4* is connected to port *1*, and port *2* to port *6*, which leads to the atmosphere. The spool remains in this position as long as pilot air under pressure is admitted to port *8*. When port *8* is connected to the atmosphere, spring *7* returns spool *3* to its initial position. The advantageous feature of the directional valve is that upon an accidental drop in pressure in the pilot (control) system connected to port *8*, spool *3* is shuttled to the position shown in Fig. *a*. This can be employed to put the operating cylinder or device in a safe position upon a failure of the control system. The principle of the valve is shown schematically in Figs. *b* and *c*.

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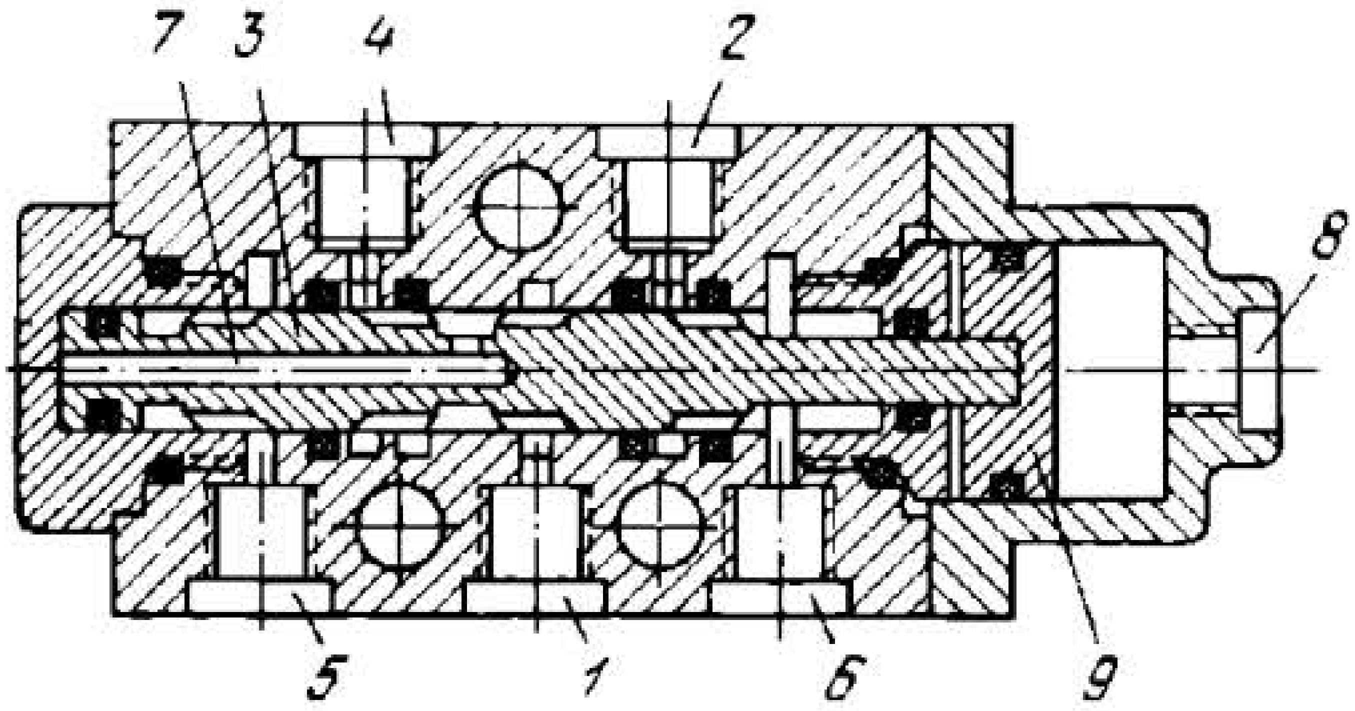
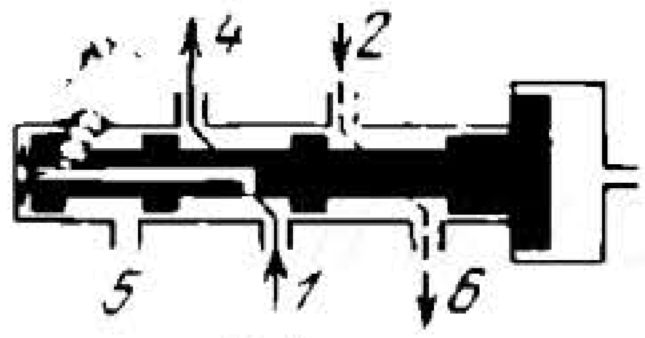
FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM

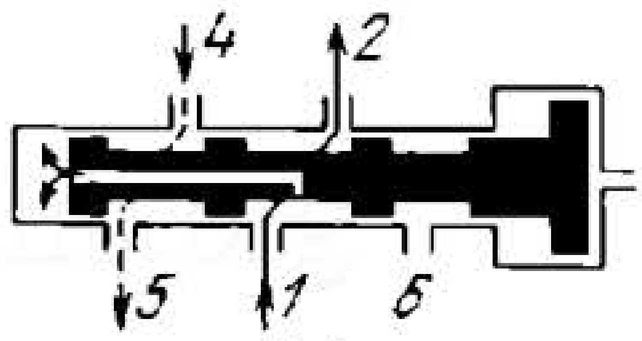
SHP FC



(a)



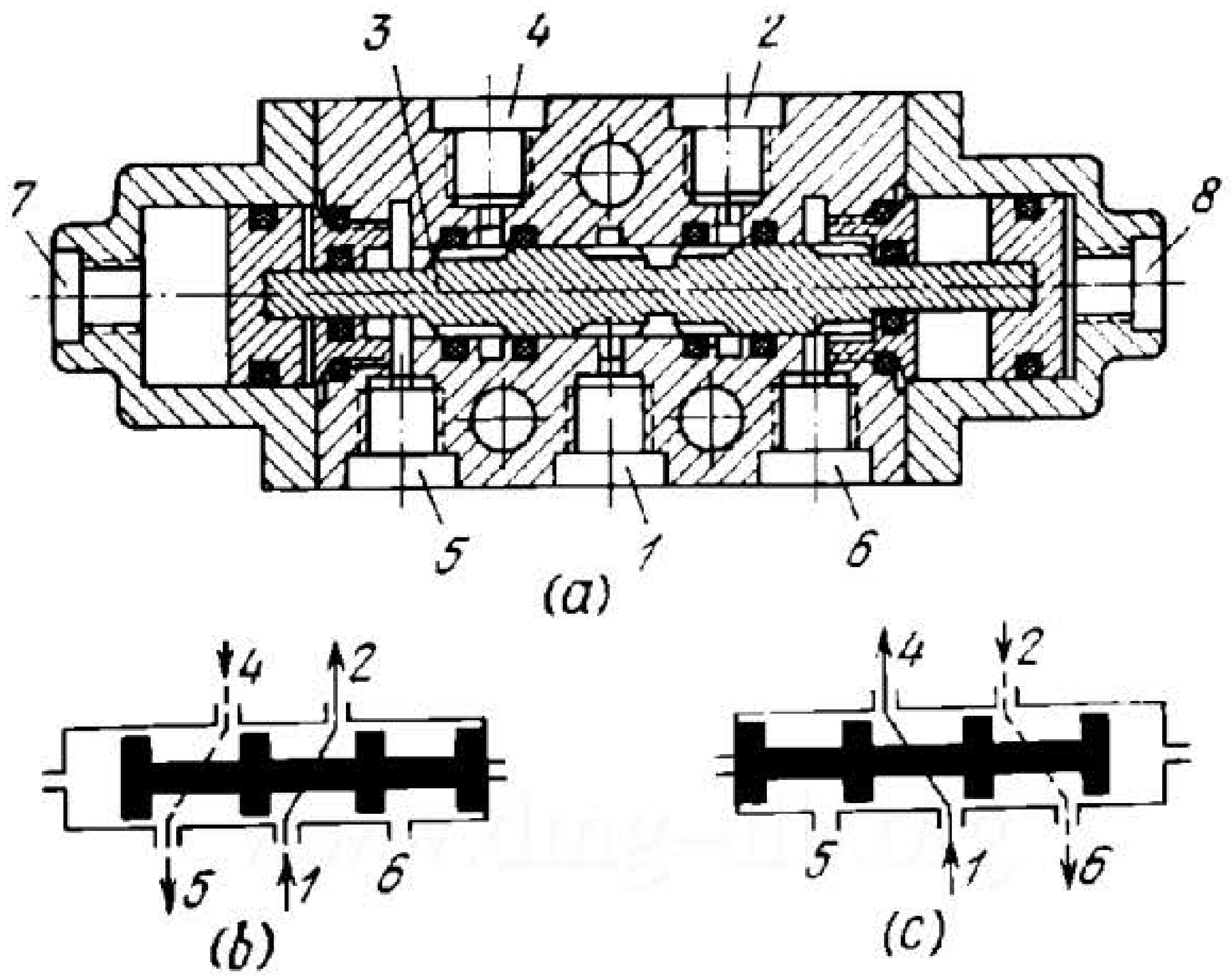
(b)



(c)

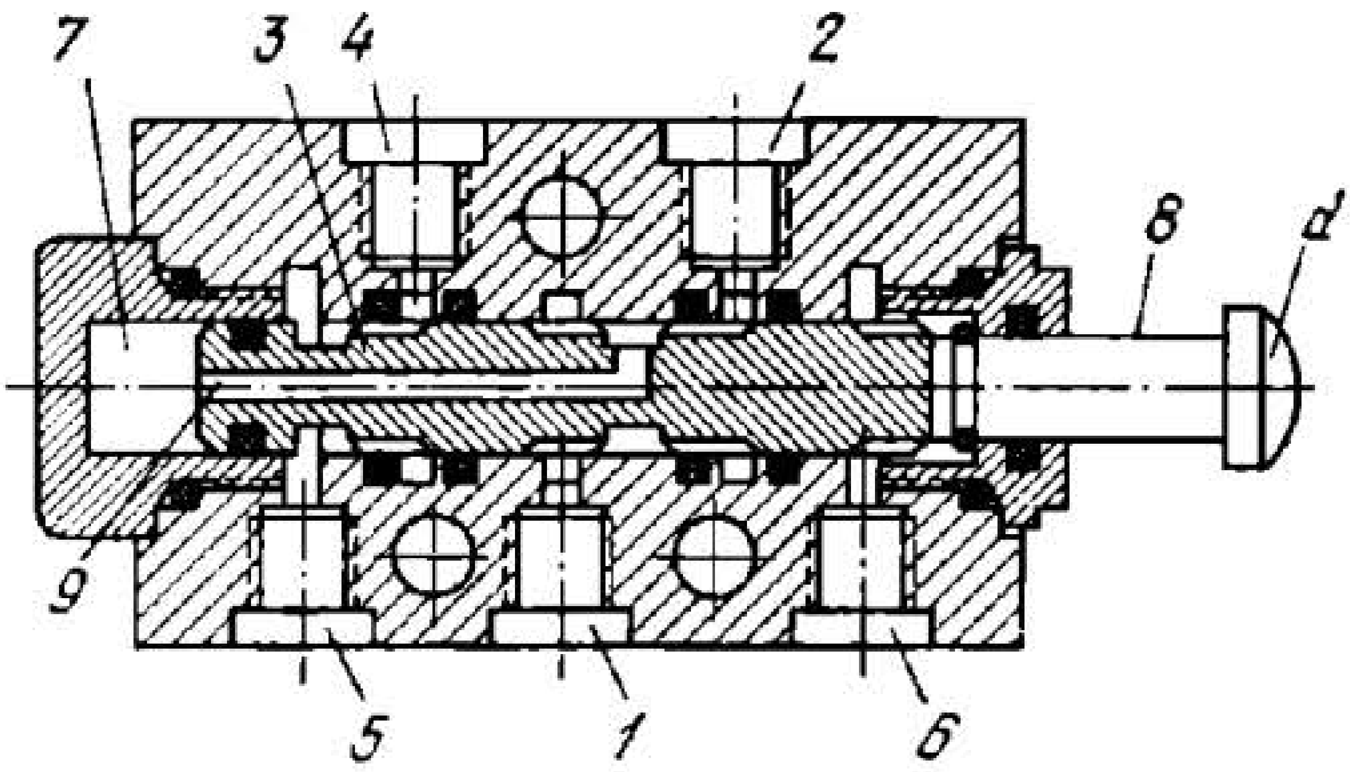
Air is supplied from the main through port *1* and further through internal channel *7* of spool *3* to the left end space of the spool (Fig. *a*). When pilot air is admitted through port *8*, then, since the cross-sectional area of piston *9* is considerably greater than that of spool *3*, the spool is shuttled to the position shown in Fig. *a*. At this, port *1*, to which compressed air is supplied from the main, is connected to port *4*, and port *2* to port *6*, which leads to the atmosphere. When port *8* is connected to the atmosphere, the pressure acting on the left end of spool *3* shuttles it to the right. This connects port *1* to port *2* and port *4* to port *5*, which leads to the atmosphere. The advantageous feature of the directional valve is the absence of a mechanical spring, and this reduces the probability of valve failure. In addition, upon an accidental drop in pressure in the pilot (control) system connected to port *8*, the valve is put into a definite position. This can be employed to put the operating cylinder or device in a safe position upon a failure of the control system. The principle of the valve is shown schematically in Figs. *b* and *c*.

3675	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC

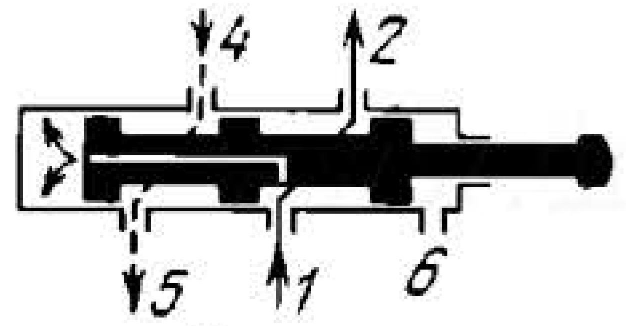


In the position of spool *3* shown in Fig. *a*, port *1*, to which compressed air is supplied from the main, is connected to port *2*, and port *4* to port *5*, which leads to the atmosphere. When pilot air is admitted through port *8*, spool *3* is shuttled to the left and remains in this position, held by the friction forces, even after port *8* is connected to the atmosphere. At this, compressed air from port *1* is admitted into port *4*, and port *2* is connected to port *6*, which leads to the atmosphere. To return spool *3* to its initial position, pilot air is admitted through port *7*. Directional valves of this type are most widely applied in various machines with systems of in-travel control. The principle of the valve is shown schematically in Figs. *b* and *c*.

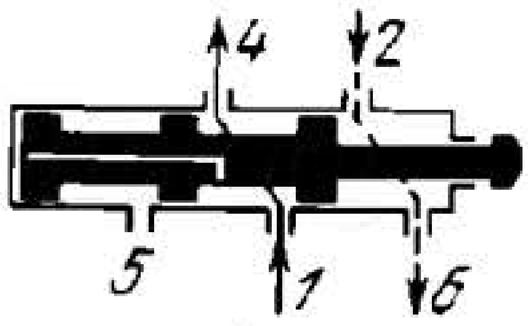
3676	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a)



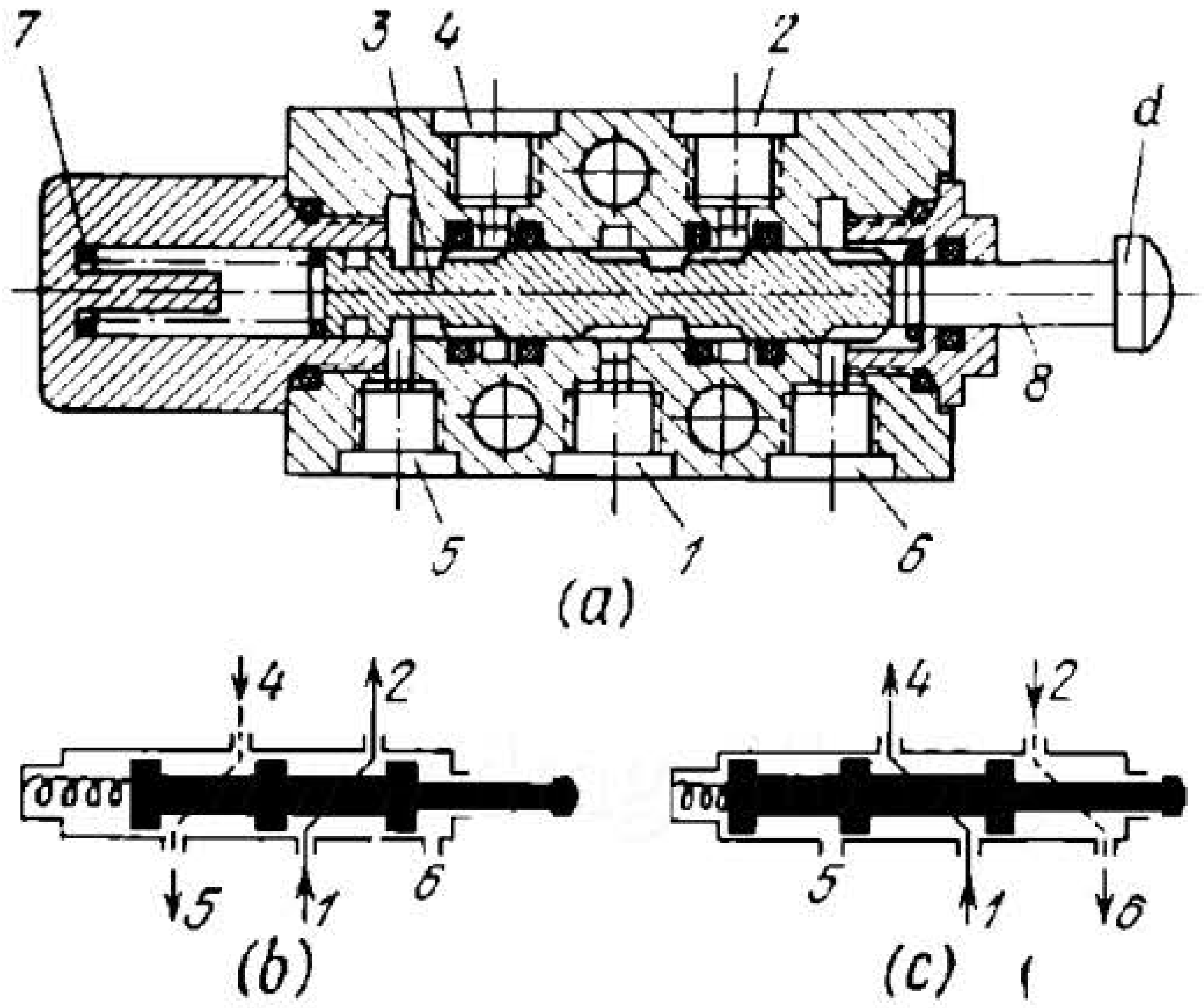
(b)



(c)

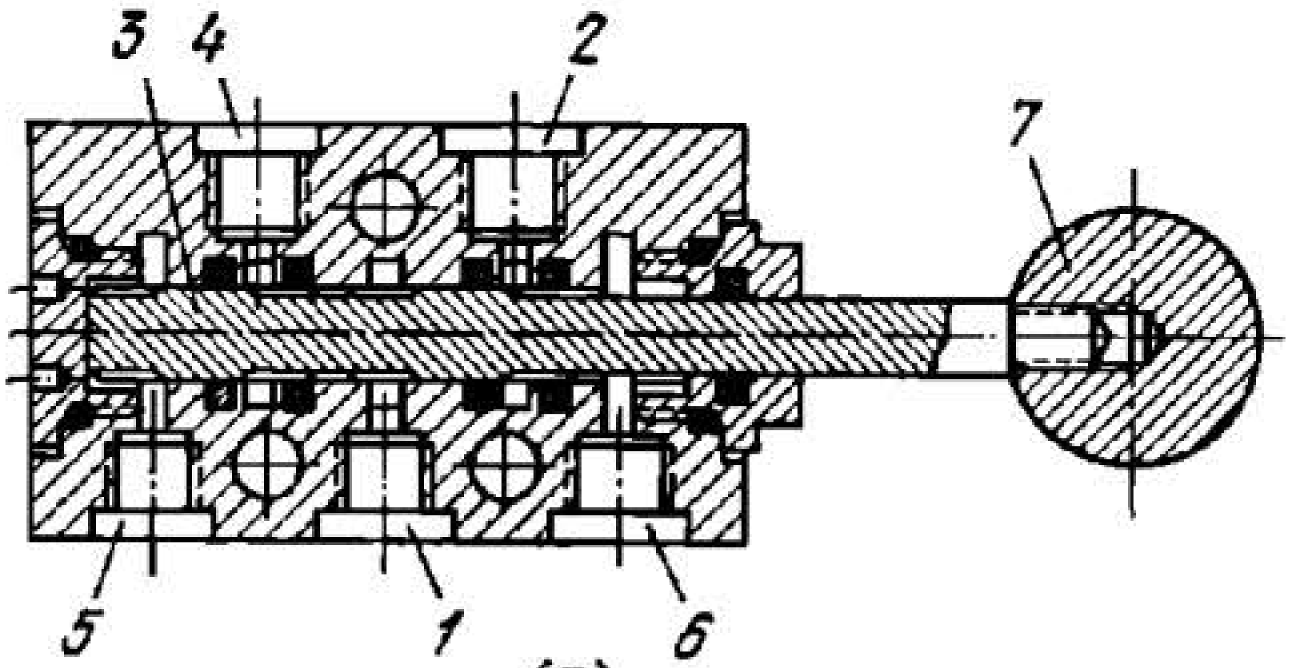
In the position of spool *3* shown in Fig. *a*, port *1*, to which compressed air is supplied from the main, is connected to port *2*, and port *4* to port *5*, which leads to the atmosphere. At the same time, compressed air is admitted through channel *9* in spool *3* into left end space *7*. The pressure acting on the left end of spool *3* shifts and holds it in the position shown in Fig. *a*. To switch over the valve, it is necessary to apply a mechanical force to head *d* of pusher *8* which exceeds that exerted by the air pressure at the left end of spool *3*. When spool *3* is shifted to its left position, air from port *1* is admitted into port *4*, and port *2* is connected to port *6*, which leads to the atmosphere. If head *d* is released, pusher *8* and spool *3* return to the position shown in Fig. *a*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3677	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP, FC

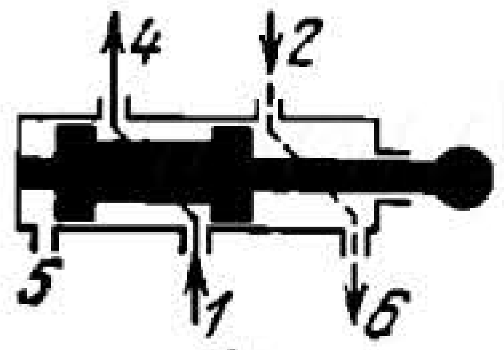


Spring 7 holds spool 3 in the position shown in Fig. *a*. At this, port 1, to which compressed air is supplied from the main, is connected to port 2, and port 4 to port 5, which leads to the atmosphere. To switch over the valve, it is necessary to apply a mechanical force to head *d* of pusher 8 which exceeds that exerted by spring 7. When spool 3 is shifted to its left position, air from port 1 is admitted into port 4, and port 2 is connected to port 6, which leads to the atmosphere. If head *d* is released, pusher 8 and spool 3 are returned by spring 7 to the position shown in Fig. *a*. The principle of the valve is shown schematically in Figs. *b* and *c*.

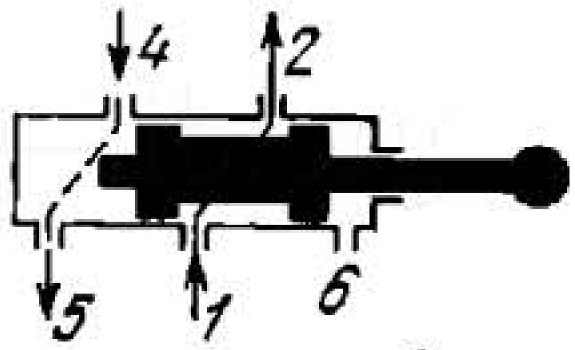
3678	FIVE-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a)



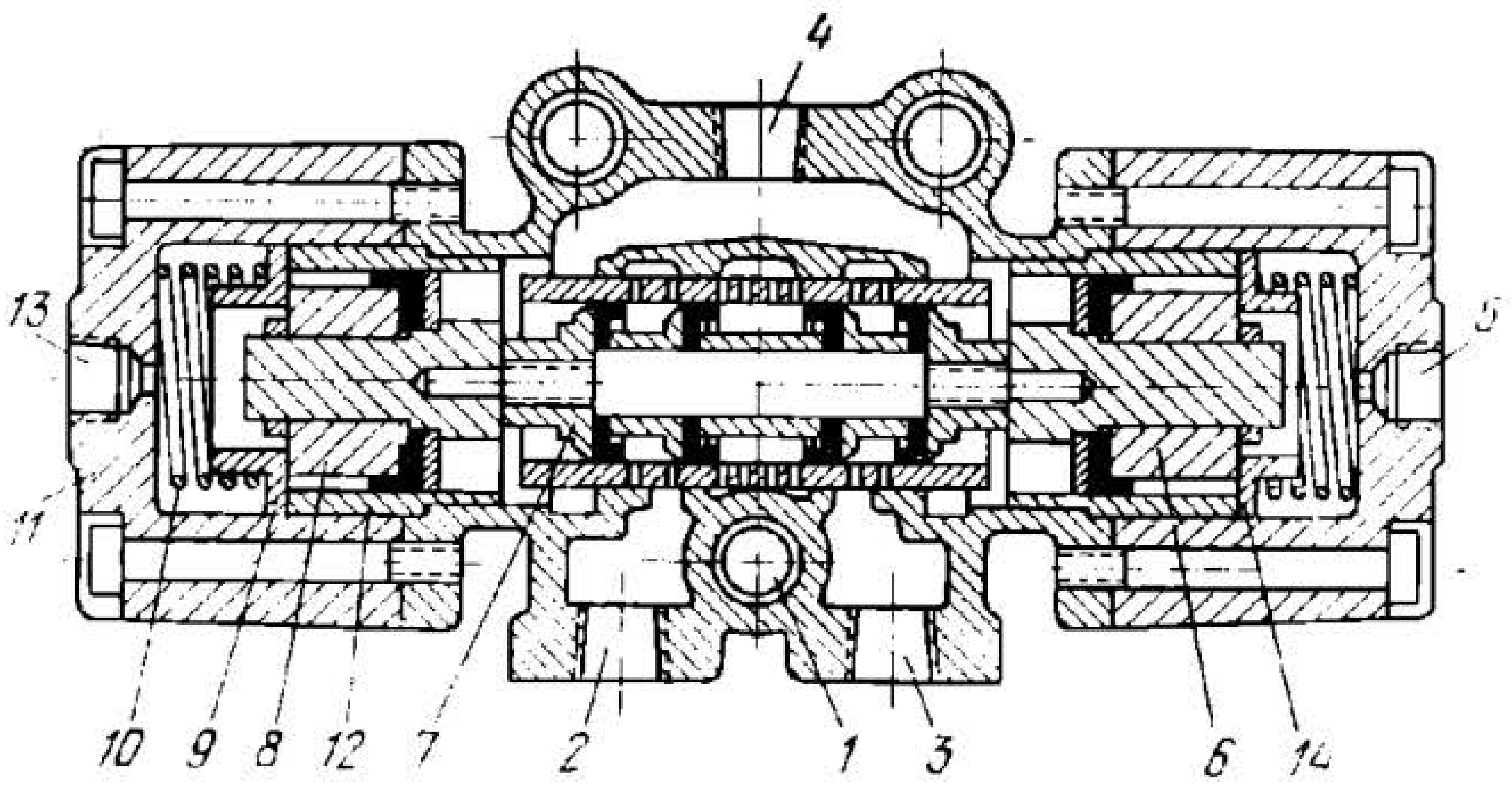
(b)



(c)

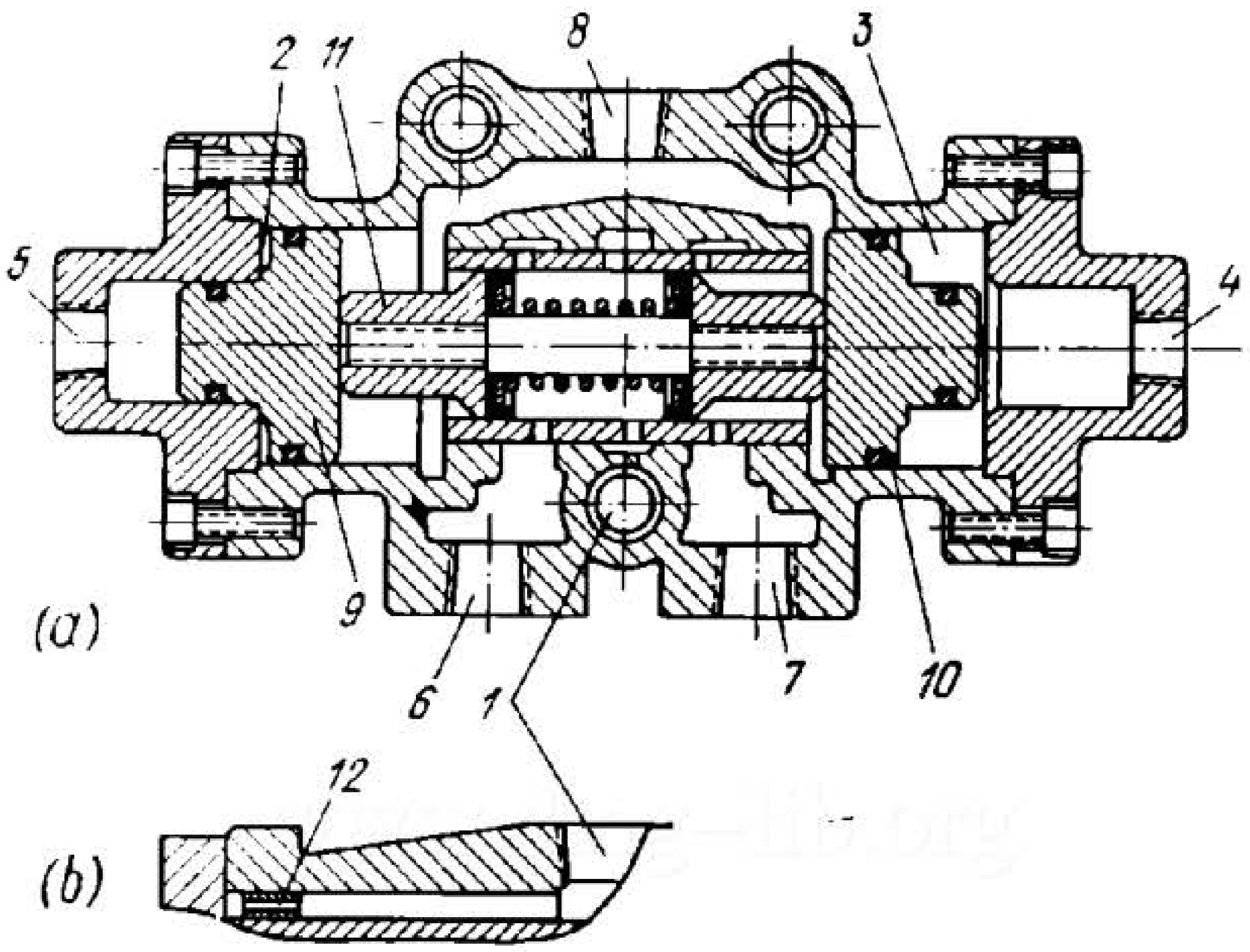
In the position of spool *3* shown in Fig. *a*, port *1*, to which compressed air is supplied from the main, is connected to port *4*, and port *2* to port *6*, which leads to the atmosphere. Spool *3* is switched over to either of its two positions manually by means of lever *7*. The spool can be linked to any mechanism (cam, lever, etc.) for shifting. When spool *3* is shifted to its right-hand position, air from port *1* is admitted into port *2*, and port *4* is connected to port *5*, which leads to the atmosphere. The principle of the valve is shown schematically in Figs. *b* and *c*.

3679	FOUR-WAY THREE-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



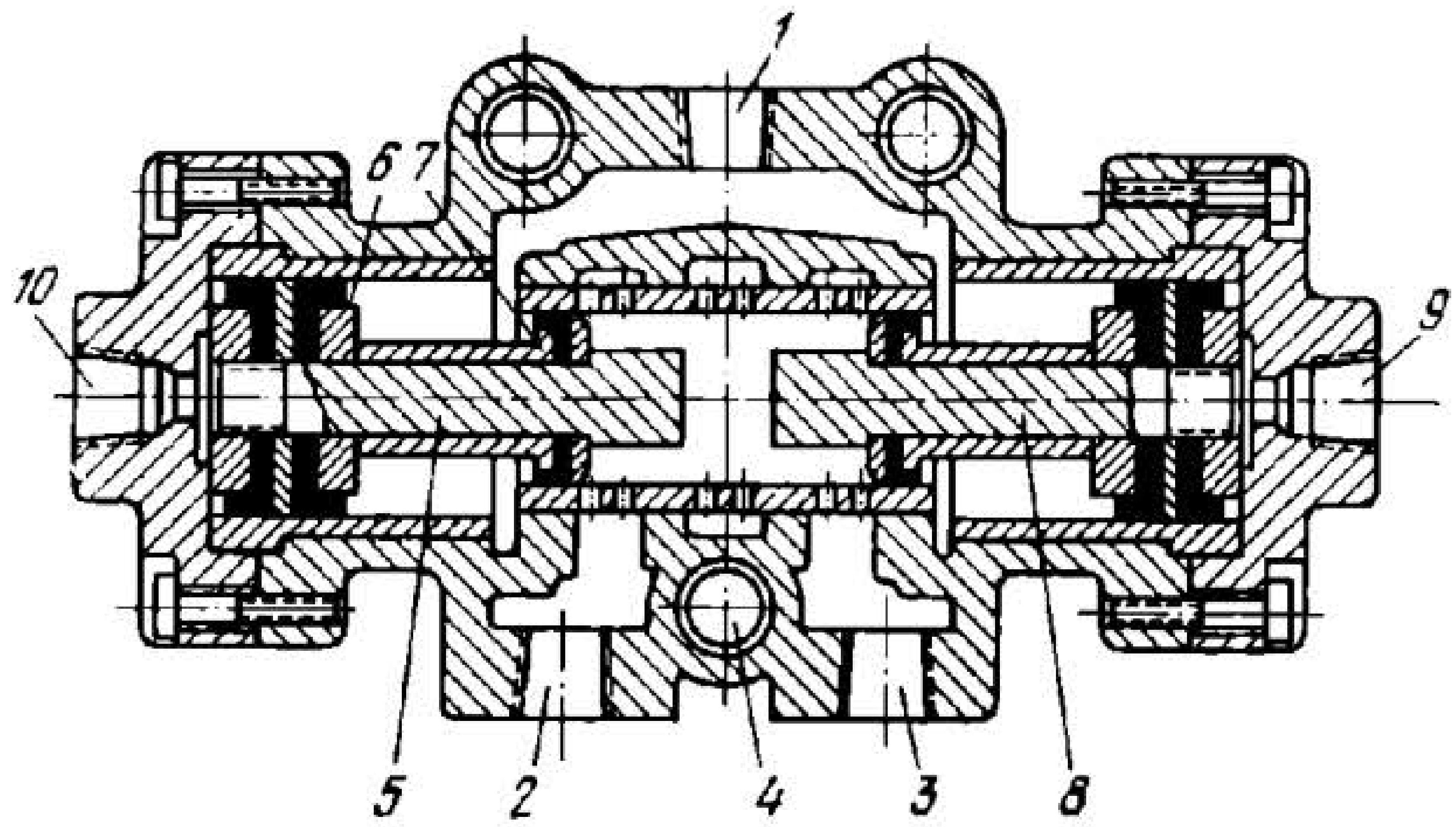
Compressed air is supplied from the main to port *1* and, in the position of spool *7* shown, both ports, *2* and *3*, connected to the ends of the operating cylinder or device, are closed off. When pilot air under pressure is admitted through port *5*, piston *6*, spool *7* and piston *8* begin to move to the left and piston *8* shifts sleeve *9*, overcoming the resistance of spring *10*. This motion continues until sleeve *9* runs up against cover *11*. After spool *7* has been thus shuttled, air from port *1* is admitted into port *2*, and port *3* is connected to port *4*, which leads to the atmosphere. If port *5* is connected to the atmosphere, sleeve *9*, actuated by spring *10*, shifts piston *8* returning spool *7* to its central position. Accurate positioning of the spool is accomplished because the motion of sleeve *9* to the right is limited by bushing *12*, and piston *6* is located by sleeve *14*. If pilot air is admitted through port *13*, spool *7* is shuttled so that air from port *1* is admitted into port *3*, and port *2* is connected to the atmosphere through port *4*.

FOUR-WAY TWO-POSITION SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM



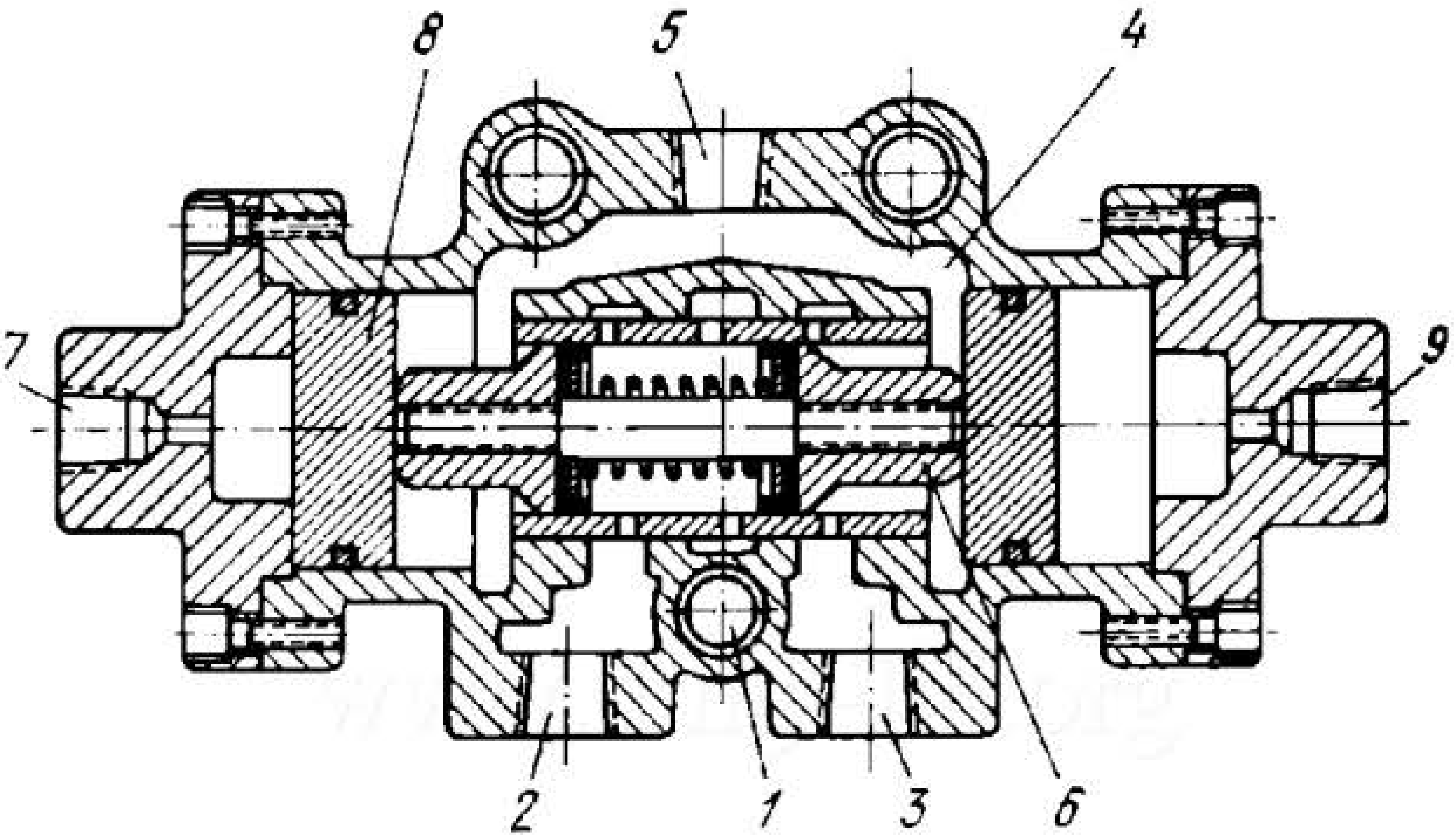
Compressed air is supplied from the main to port *1* (Fig. *a*), two channels in the valve body and through throttling orifices *12* (Fig. *b*) into end spaces *2* and *3*. At this, ports *4* and *5* are shut off by two-port pilot valves and spool *11* is in the position shown in Fig. *a*. In this position air is admitted from port *1* into port *6*, which is connected to one end of the operating cylinder or device. Port *7* is connected to port *8*, which leads to the atmosphere. If the two-port valve connected to port *4* is opened, then, in case the flow of air through the connecting pipeline and valve is greater than the amount admitted through throttling orifice *12* (Fig. *b*), the pressure in end space *3* drops and that in end space *2* remains constant. Owing to the difference in pressure, piston *9*, spool *11* and piston *10* are shifted to the right. To prevent excessive loss of air at the end of the stroke since the two-port valve may remain open, piston *10* disconnects end space *3* from port *4*. After the spool is shuttled, air from port *1* is admitted into port *7* and further to the actuator (operating cylinder or device), and port *6* is connected to the atmosphere through port *8*.

3681	FOUR-WAY THREE-POSITION PLUNGER-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



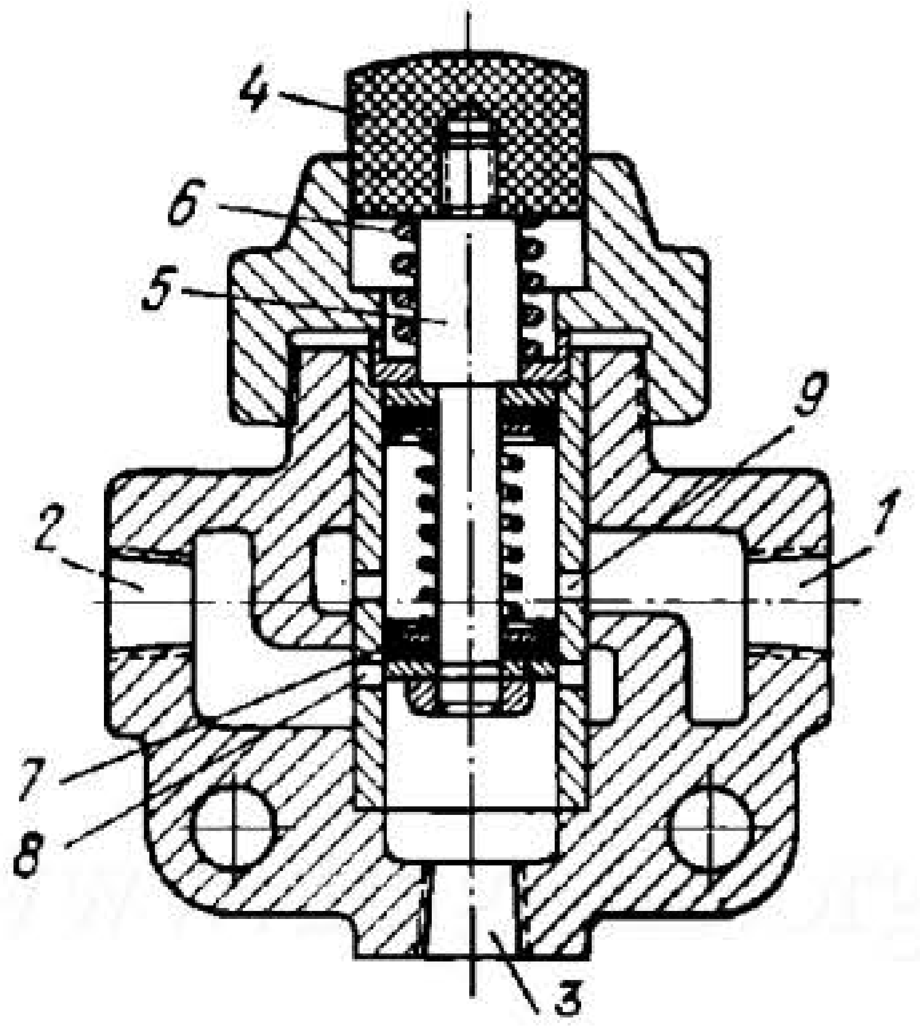
Compressed air is supplied from the main to port *1* and fills the internal chamber of the directional valve. Since the effective area of piston *6* of plunger *5* is greater than that of piston *7*, plunger *5* is held in the position shown by the difference in the forces exerted by the pressure. In the same way, plunger *8* is held in the position shown. At this, both ports, *2* and *3*, connected to the actuator (operating cylinder or device), are connected to port *4*, which leads to the atmosphere. When pilot air under pressure is admitted into port *9*, plunger *8* begins to move to the left, and compressed air from port *1* is admitted into port *3* and further into the actuator. Port *2*, as before, is connected to the atmosphere. If port *9* is connected to the atmosphere, and compressed air is admitted into port *10*, then plunger *5* is shifted to the left, and air from port *1* is admitted into port *2*. At the same time, plunger *8* is pushed back to the right to its initial position (as shown) and port *3* is connected to the atmosphere through port *4*.

3682	FOUR-WAY TWO-POSITIONJ SPOOL-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



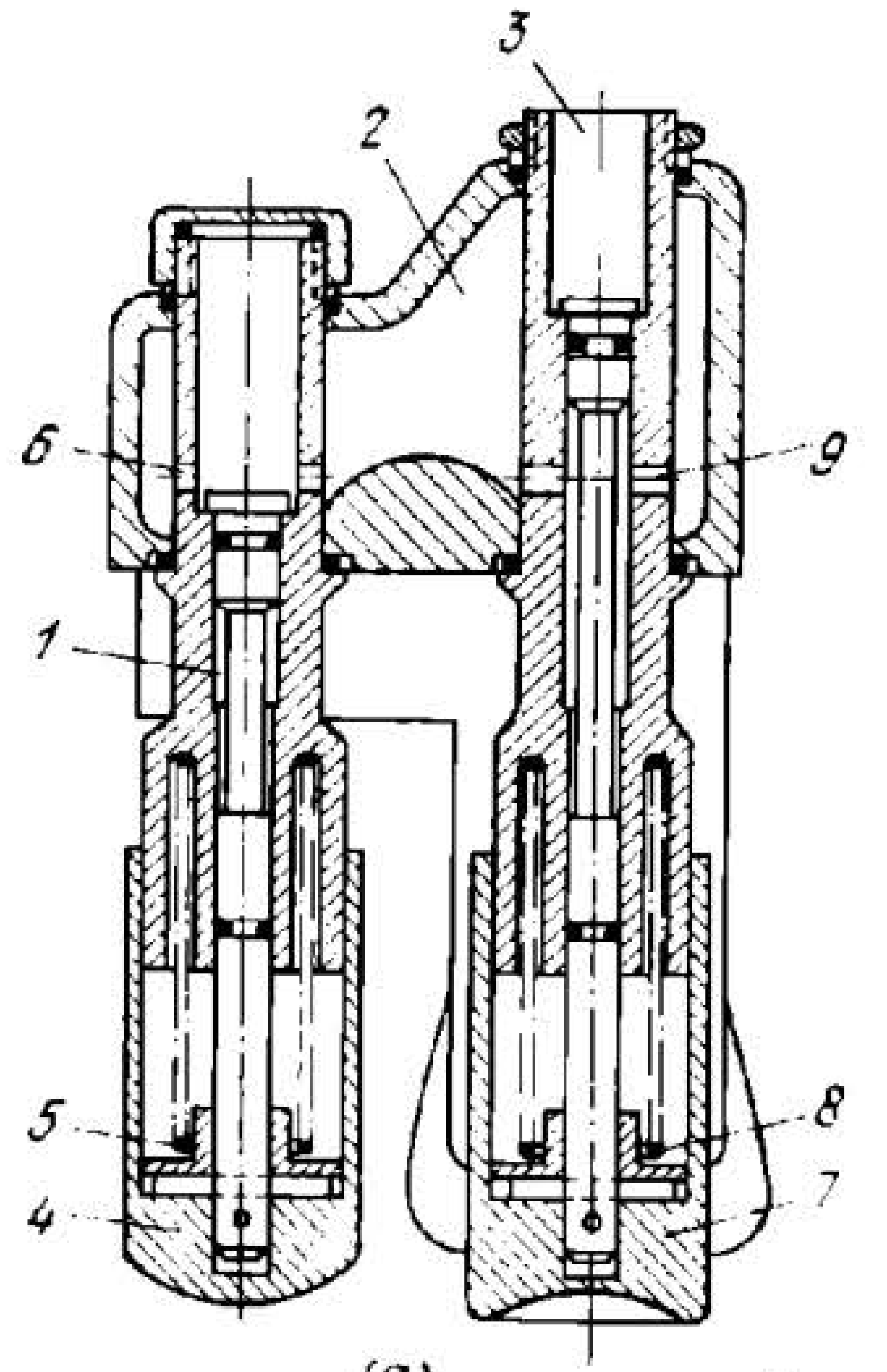
Compressed air is supplied from the main to port *1* and, in the position shown, is admitted by spool *6* into port *2*, which is connected to the actuator (operating cylinder or device). Port *3* is connected to the internal chamber *4* of the valve, which is connected to the atmosphere through port *5*. When compressed (pilot) air is admitted through port *7*, piston *8* is shifted to the right and it shifts over spool *6*. At this, port *3* is connected to port *1*, and port *2* is connected to the atmosphere through chamber *4*. To return the spool to its initial position, pilot air is admitted through port *9*.

3683	THREE-WAY TWO-POSITION SPOOL-TYPE PALM-BUTTON-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC

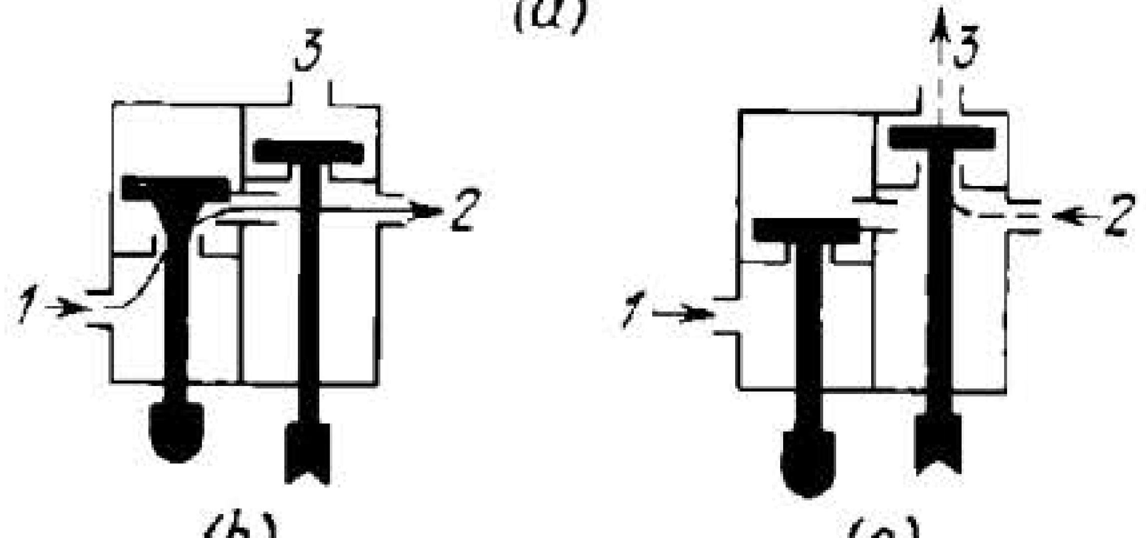


Compressed air is supplied from the main to port *1*, and port *2*, the outlet port of the valve, is connected to the atmosphere through port *3*. When palm button *4* is pressed, spool *5* is pushed downward, overcoming the resistance of spring *6*. In its downward motion, lower packing cup *7* of the spool passes a row of radial ports *8*, disconnecting them from port *3* and the atmosphere. Air from port *1* passes through a row of radial ports *9* into outlet port *2*. When palm button *4* is released, spool *5* is returned by spring *6* to the position shown. The valve can be used as a two-way valve if a plug is screwed into port *3*.

3684	THREE-WAY TWO-POSITION BUTTON-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



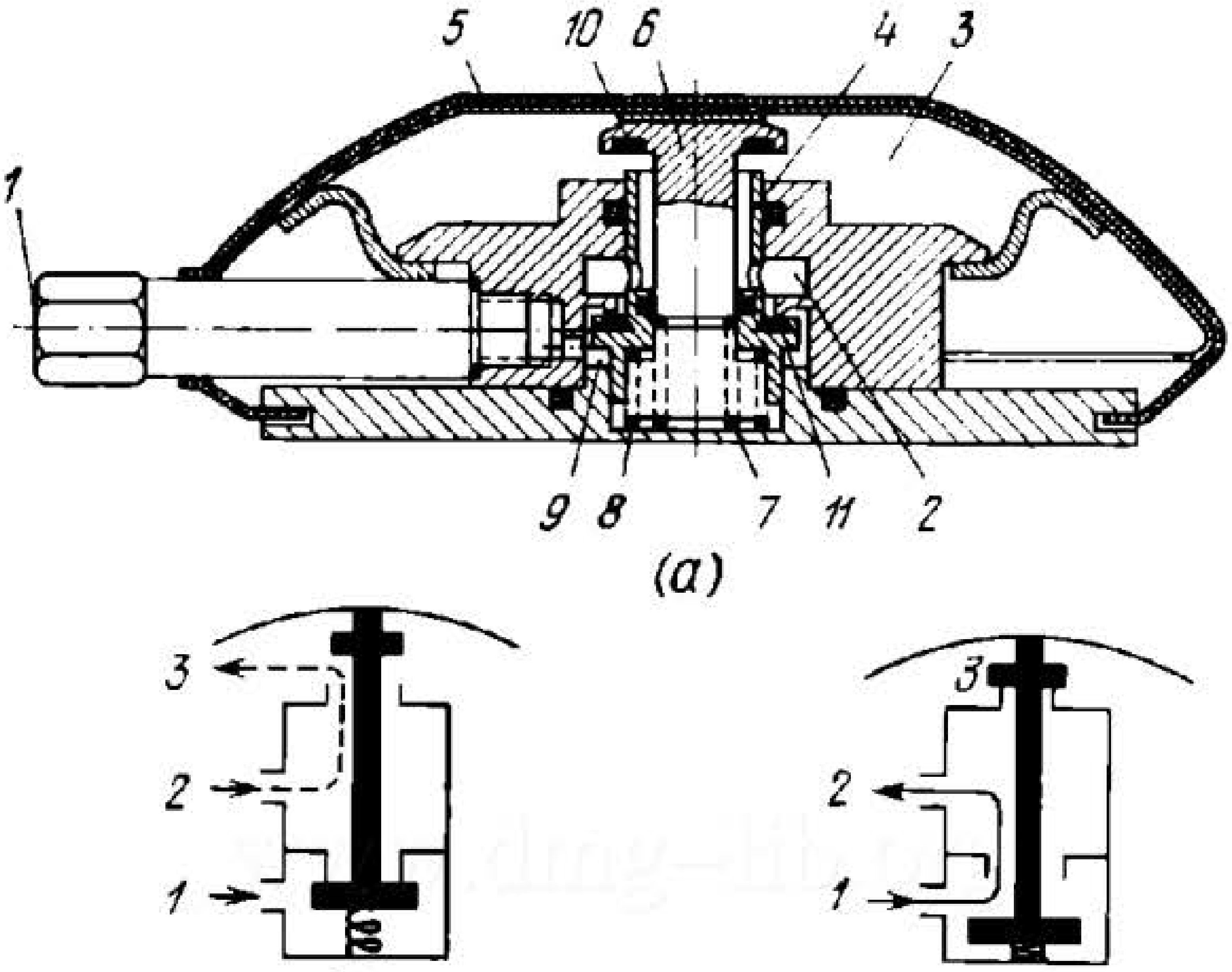
(a)



(b) (c)

Compressed air is supplied from the main to chamber *1* (Fig. *a*). Chamber *2* is the valve outlet and port *3* is connected to the atmosphere. When button *4* is pressed, compressing spring *5*, the plunger linked to the button is pushed off its seat. Air from chamber *1* passes through a row of ports *6* into outlet chamber *2*. When button *4* is released, it is returned, together with the plunger, by spring *5* to its initial position, shutting off air flow into chamber *2*. When button *7* is pressed, compressing spring *8*, the plunger linked to this button is pushed off its seat, and outlet chamber *2* is connected to the atmosphere through ports *9* and *3*. This valve is designed with a pistol grip and is portable. The principle of the valve is shown schematically in Figs. *b* and *c*: with button *4* pressed (Fig. *b*), and with button *7* pressed (Fig. *c*).

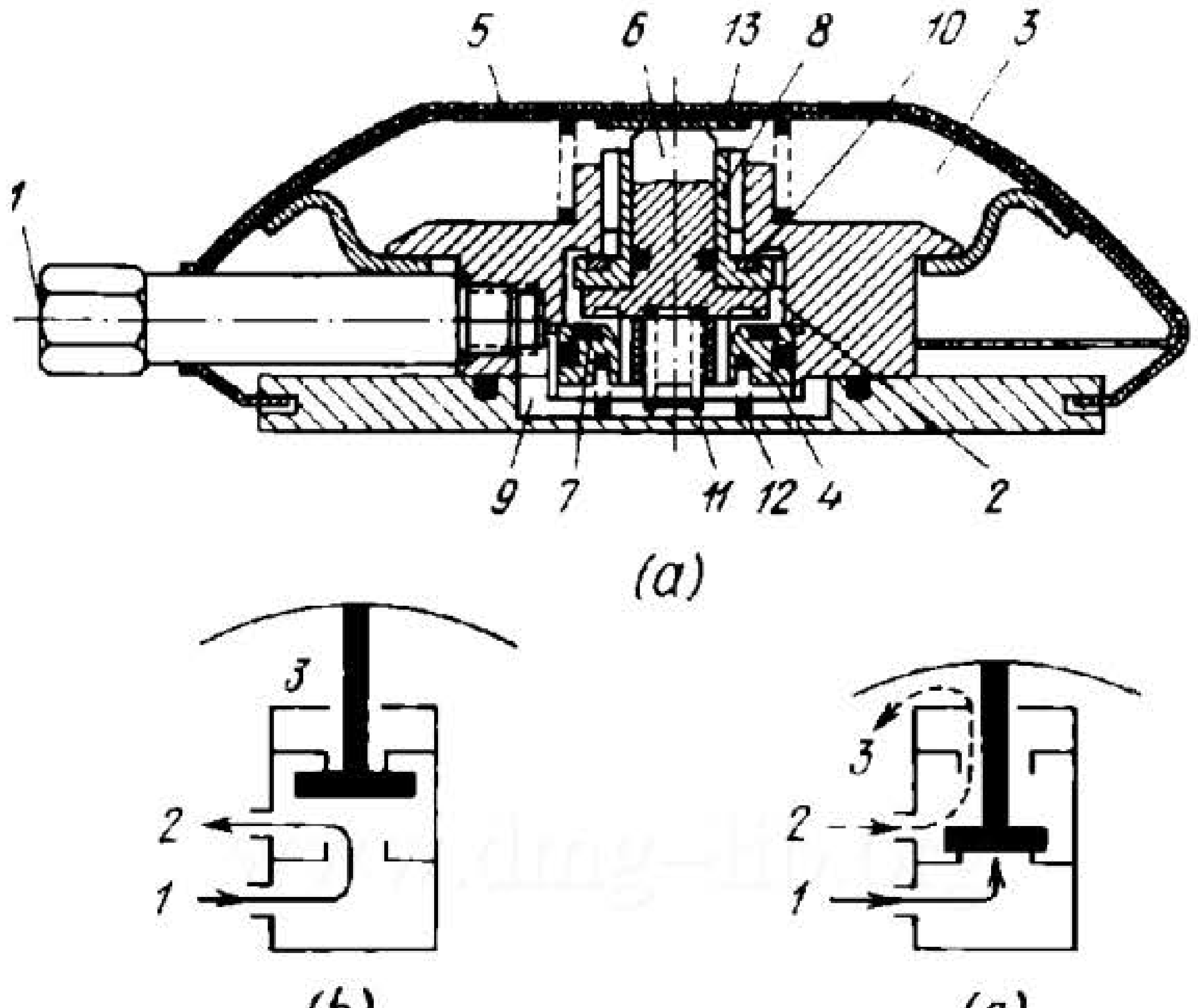
3685 | **THREE-WAY TWO-POSITION POPPET-TYPE MEMBRANE-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM** | SHP FC



(a) (b) (c)

When there is no mechanical actuation, compressed air, supplied from the main, passes through connection *1* into chamber *9* (Fig. *a*). Chamber *2*, the valve outlet, is connected to chamber *3* which is connected to the atmosphere through holes and a central channel in bushing *4*. When rubber membrane *5* is pressed, plunger *6* is pushed downward. At first, rubber insert *10* closes off the central channel in bushing *4*, disconnecting chambers *2* and *3*. Upon further motion of the plunger, it shifts bushing *4* downward so that rubber insert *11* is pushed off its seat. At this, compressed air from chamber *9* passes into valve outlet chamber *2*. When membrane *5* is released, bushing *4* and plunger *6* are returned to their initial positions by springs *8* and *7*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3686	**THREE-WAY TWO-POSITION POPPET-TYPE MEMBRANE-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM**	**SHP** **FC**



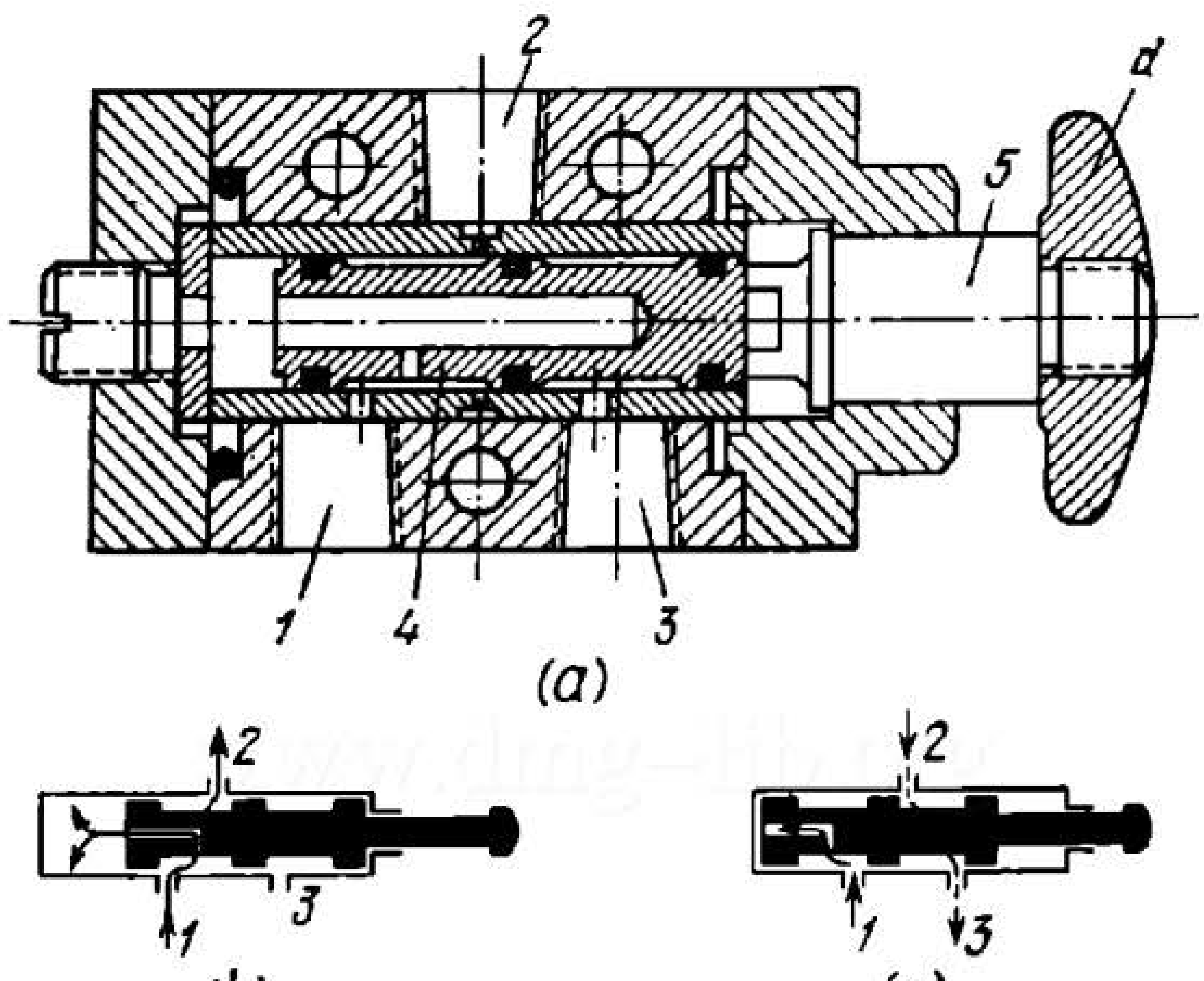
When there is no mechanical actuation, compressed air, supplied from the main, passes through connection *1* into chamber *9* and further through channels in valve member *4* into valve outlet chamber *2* (Fig. *a*). When rubber membrane *5* is pressed, plunger *6* is pushed downward. At first, the annular projection of the plunger runs up against rubber insert *7* of valve member *4*, disconnecting chambers *9* and *2*. At this time, bushing *8* is held in its upper position by the pressure of air acting on its lower end. Upon further motion of membrane *5*, disk *13* presses bushing *8* downward so that rubber insert *10* is pushed off its seat. At this, chamber *2* is connected through the longitudinal slots in bushing *8* to chamber *3*, which is connected to the atmosphere. When membrane *5* is released, plunger *6* and valve member *4* are returned to their initial positions by springs *11* and *12*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3687

THREE-WAY TWO-POSITION SPOOL-TYPE PALM-BUTTON-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM

SHP

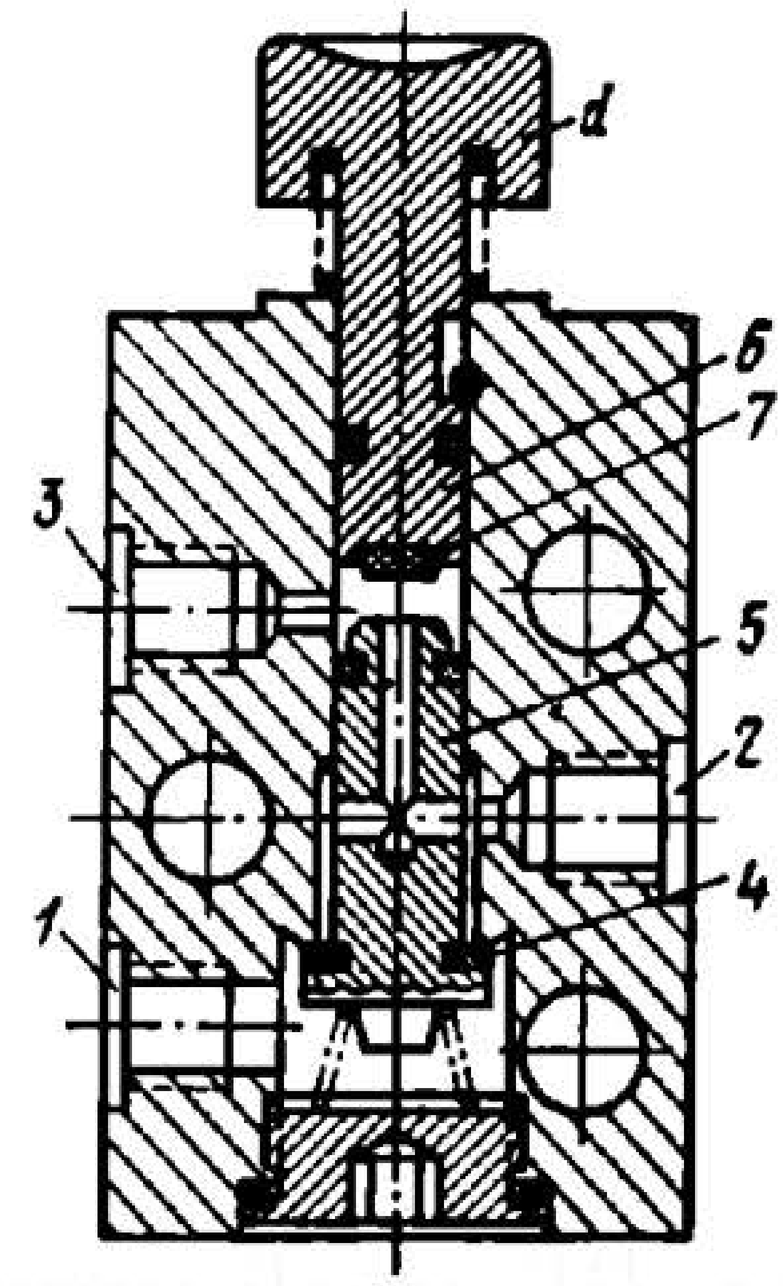
FC



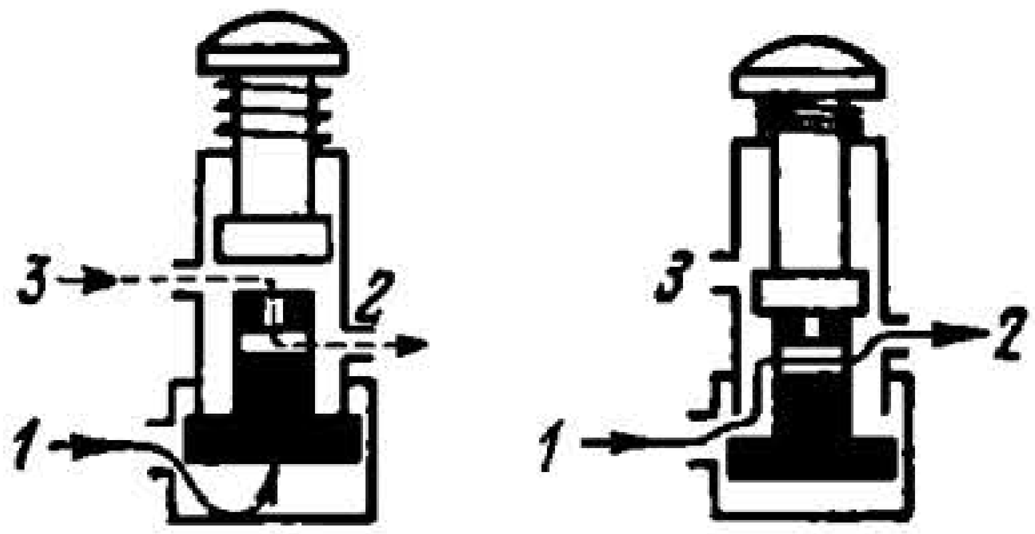
(b) (c)

Compressed air, supplied from the main to port *1*, is admitted through the channel in spool *4* to the left end space of the spool, holding spool *4* in the position shown in Fig. *a*. At this, air from port *1* is admitted into port *2*. When palm button *d* of pusher *5* is pressed, spool *4* is shifted to the left and connects port *2* to port *3*, which is connected to the atmosphere. The principle of the valve is shown schematically in Figs. *b* and *c*.

3688	THREE-WAY TWO-POSITION POPPET-TYPE PALM-BUTTON-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



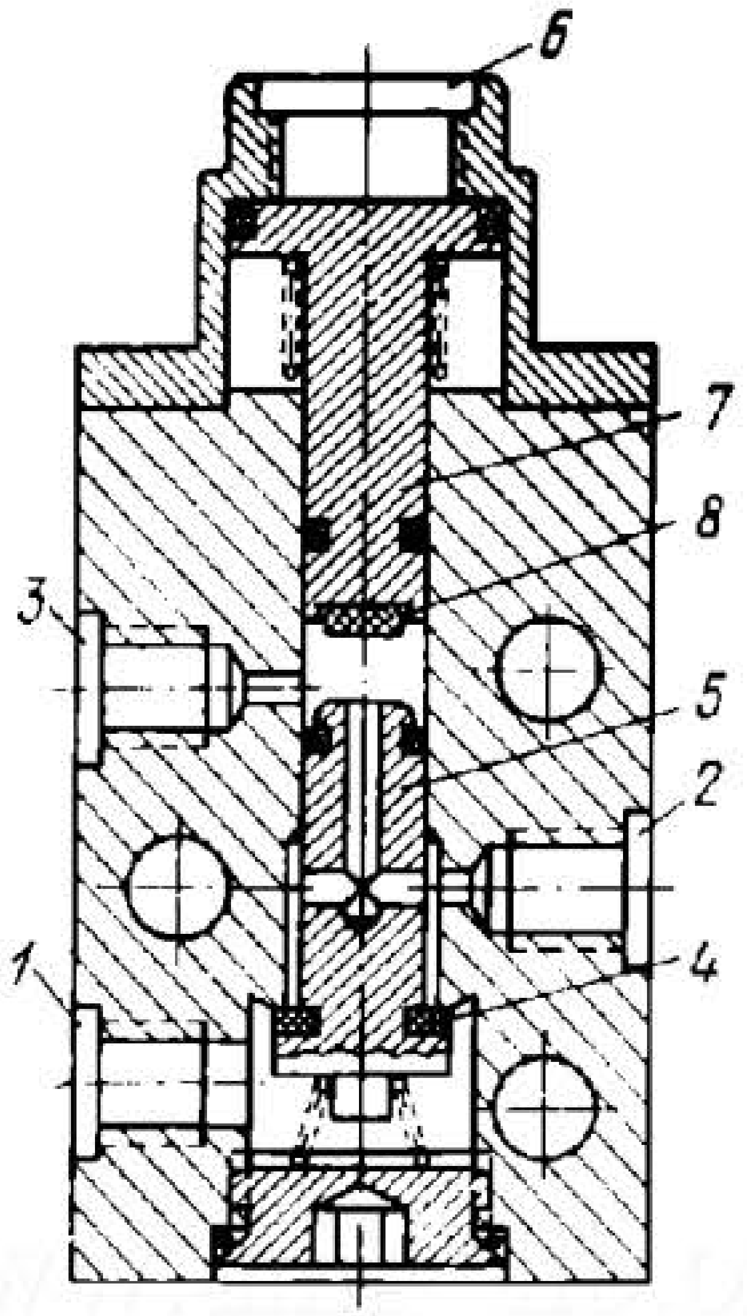
(a)



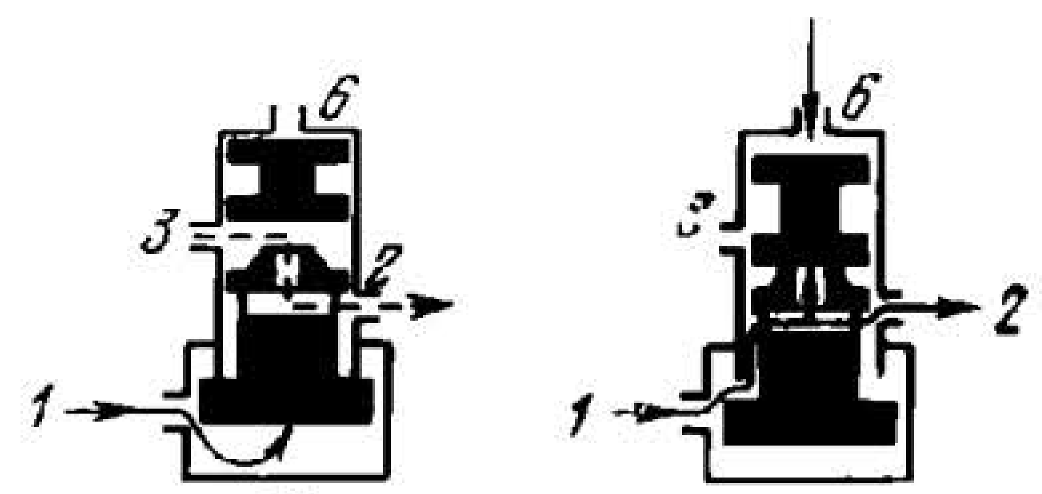
(b) (c)

The directional valve shown in Fig. *a* can be employed either as a normally closed or normally open valve, which is mechanically operated from one side. When used as a normally closed valve, compressed air is supplied from the main to port *1*, and port *2*, the outlet port, is connected through a channel in valve member *5* to port *3*, which is connected to the atmosphere. The valve is operated by pressing palm button *d* of plunger *6*. As the plunger is shifted downward, first rubber insert *7* shuts off the channel in valve member *5*, disconnecting port *2* from the atmosphere. Upon further motion, rubber insert *4* of valve member *5* is pushed off its seat. At this, air from port *1* is admitted into port *2*. When used as a normally open valve, compressed air is supplied from the main to port *3*, and port *1* is used for connection to the atmosphere. The given design has a palm button for manual operation. Other versions can be operated by levers or other mechanisms. The principle of the valve when used as normally closed is shown schematically in Figs. *b* and *c*.

3689	THREE-WAY TWO-POSITION POPPET-TYPE PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



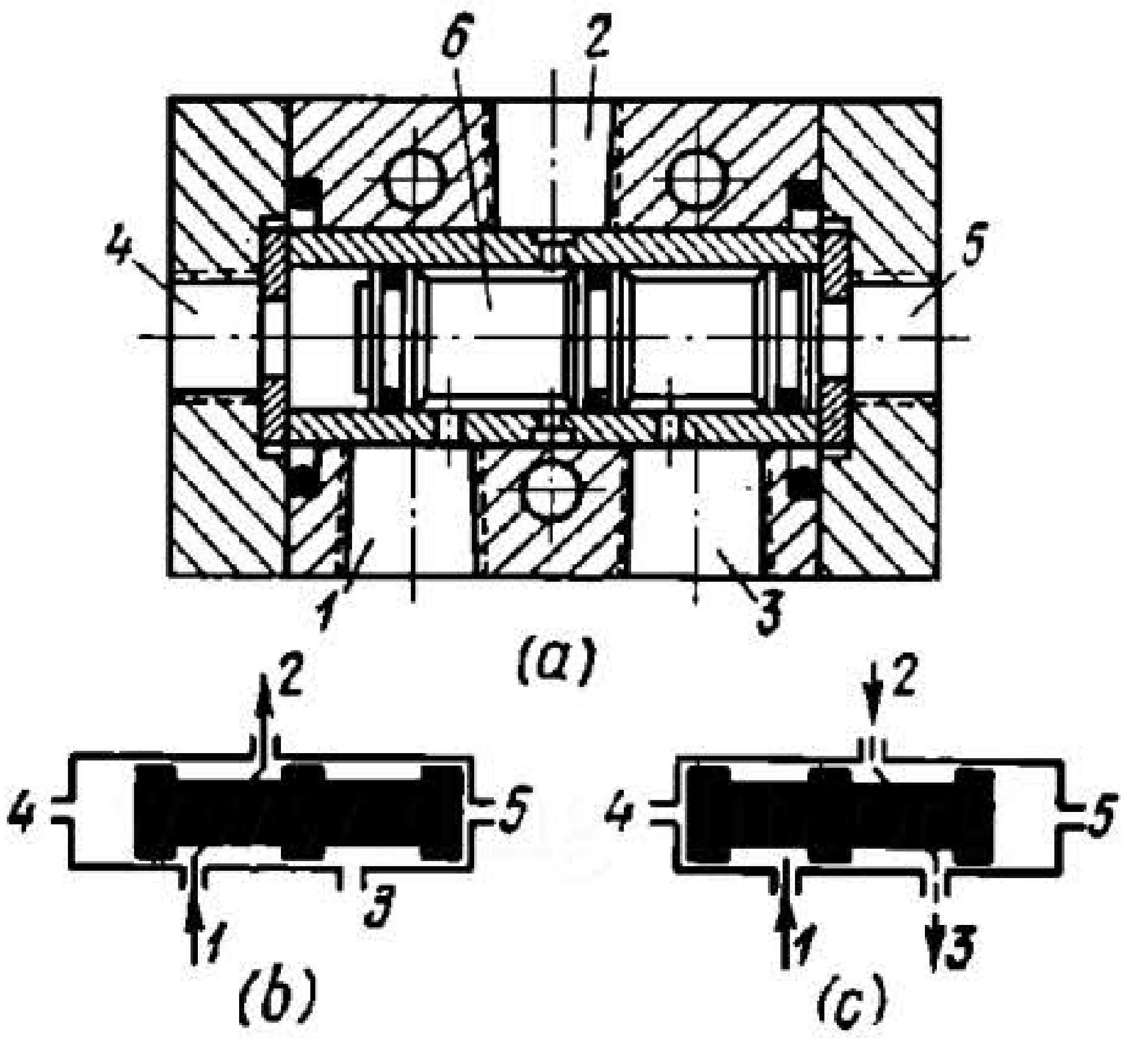
(a)



(b) (c)

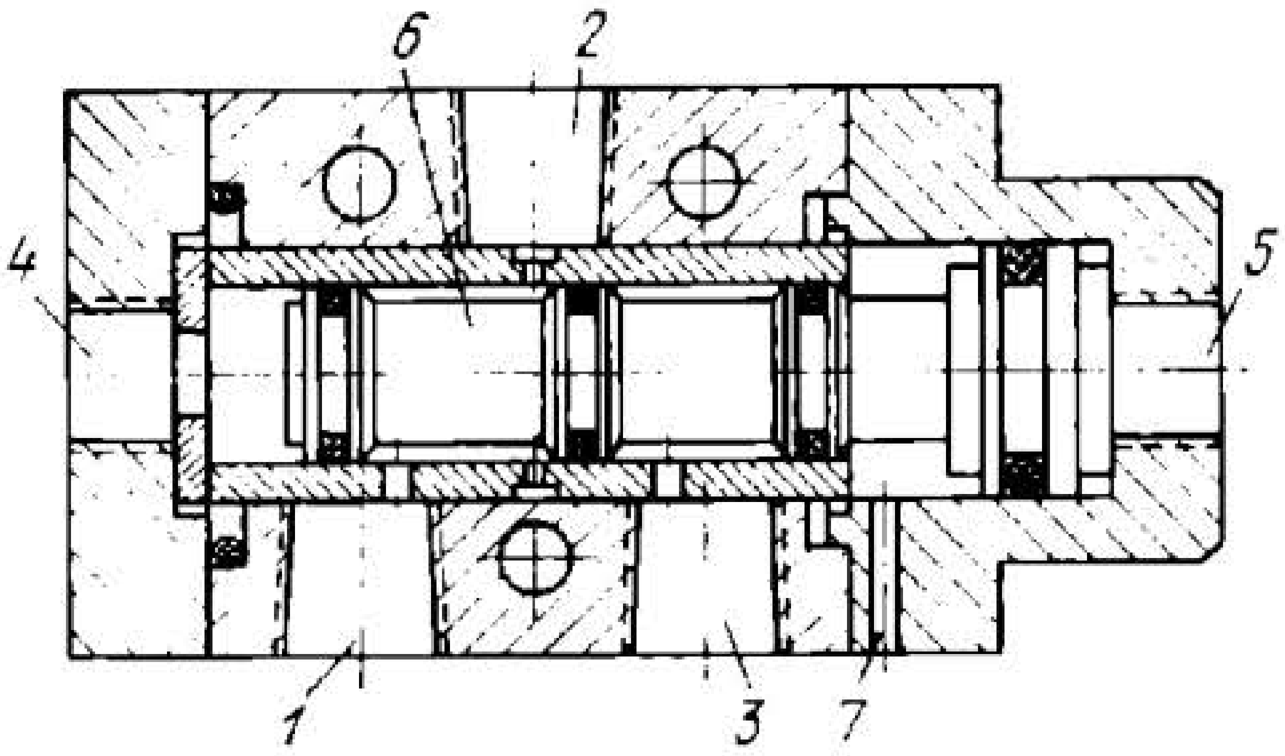
The directional valve shown in Fig. *a* can be employed either as a normally closed or normally open valve, which is pilot-operated from one side. When used as a normally closed valve, compressed air is supplied from the main to port *1*, and port *2*, the outlet port, is connected through a channel in valve member *5* to port *3*, which is connected to the atmosphere. The valve is operated when compressed pilot air is admitted into port *6*. As plunger *7* is shifted downward by air pressure exerted on its piston, first rubber insert *8* shuts off the channel in valve member *5*, disconnecting port *2* from the atmosphere. Upon further motion, rubber insert *4* of valve member *5* is pushed off its seat. At this, air from port *1* is admitted into port *2*. When the pilot air is switched off and port *6* is connected to the atmosphere, plunger *7* with its piston and valve member *5* are returned by the action of springs to the positions shown in Fig. *a*. When used as a normally open valve, compressed air is supplied from the main to port *3*, and port *1* is used for connection to the atmosphere. The principle of the valve when used as normally closed is shown schematically in Figs. *b* and *c*.

THREE-WAY TWO-POSITION SPOOL-TYPE PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM

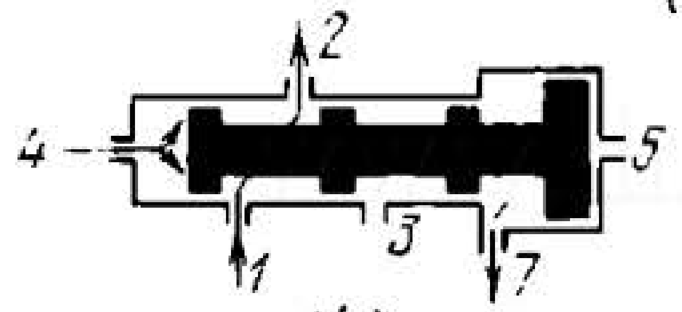


In the position of spool *6* shown in Fig. *a*, port *1*, supplied by compressed air from the main, is connected to port *2*. Port *3*, connected to the atmosphere, is closed off. When pilot air is admitted to port *5* and port *4* is connected to the atmosphere, spool *6* is shuttled to the left and held in this position by friction even after port *5* is connected to the atmosphere. At this, port *2* is connected to the atmosphere through port *3*, and port *1* is blocked. The principle of the valve is shown schematically in Figs. *b* and *c*.

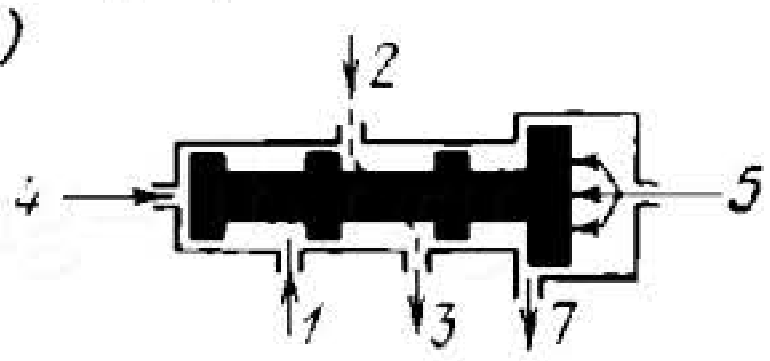
3691	THREE-WAY TWO-POSITION SPOOL-TYPE DIFFERENTIAL-PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a)



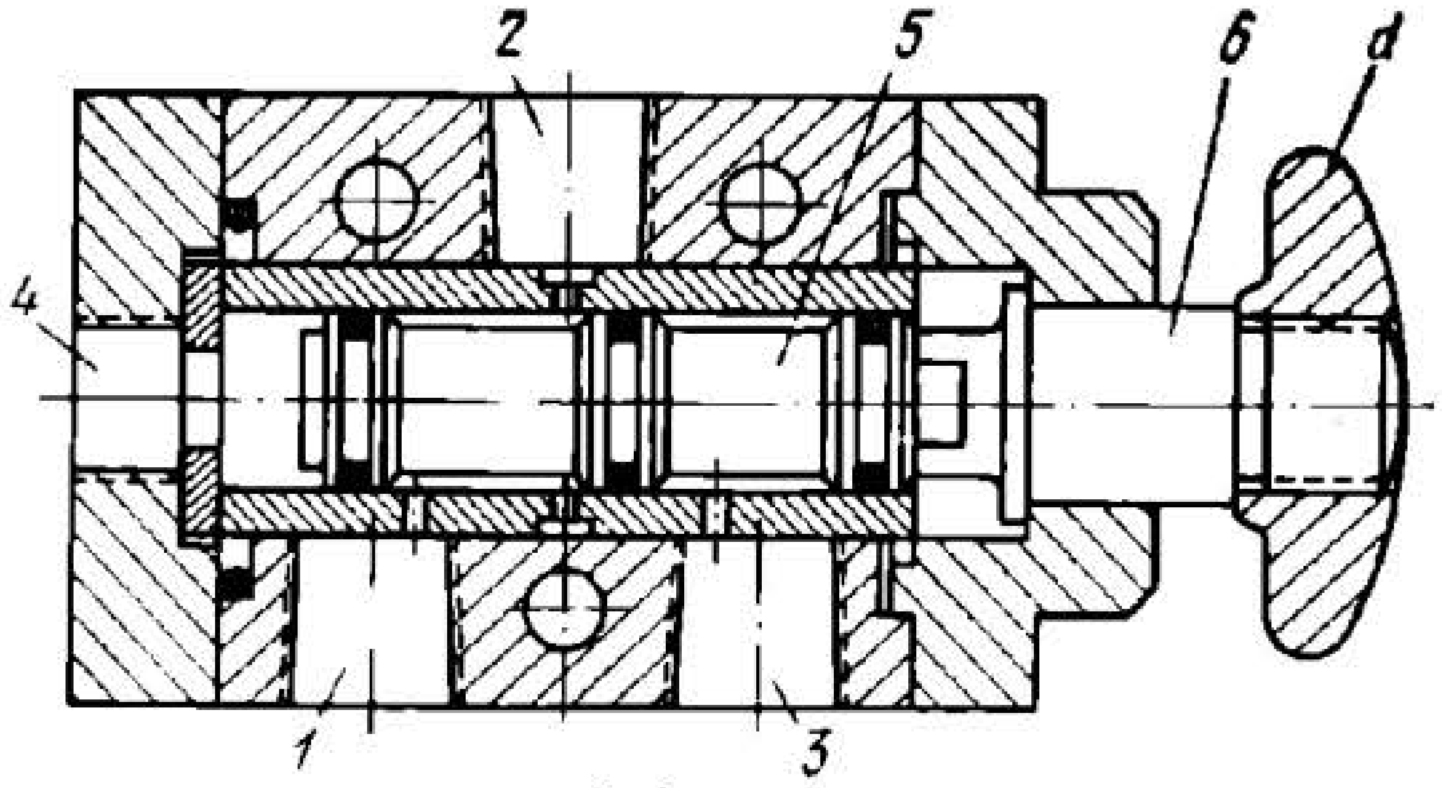
(b)



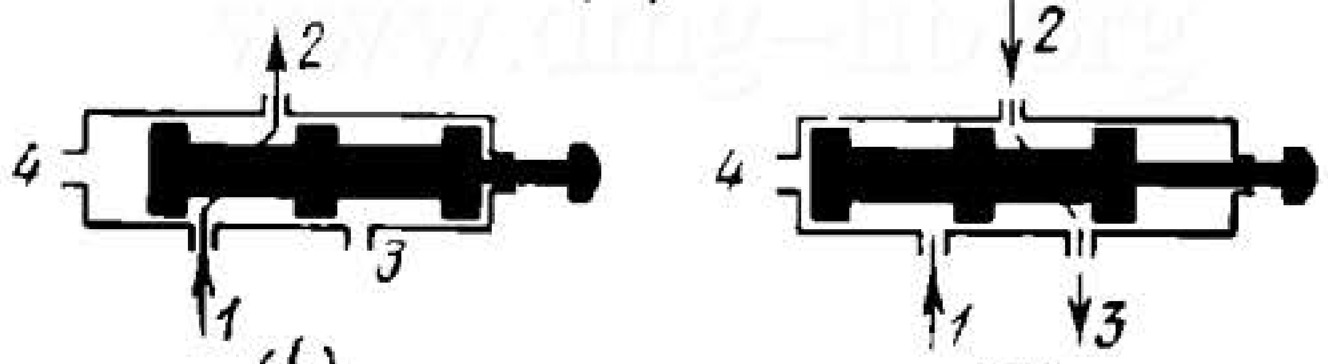
(c)

When pilot air is admitted into port *4*, spool *6* is shuttled to the position shown in Fig. *a*, and port *1*, supplied by compressed air from the main, is connected to port *2*. Port *3*, connected to the atmosphere, is closed off. When pilot air is admitted to port *5* without cutting off air admission to port *4*, spool *6* moves to the left because the right end of spool *6* is of greater area than its left end. This blocks port *1*, and port *2* is connected to the atmosphere through port *3*. Channel *7* is connected at all times to the atmosphere. When air supply is cut off to both ports, *4* and *5*, spool *6* will remain in either of its extreme positions owing to friction. The principle of the valve is shown schematically in Figs. *b* and *c*.

THREE-WAY TWO-POSITION SPOOL-TYPE PALM-BUTTON-AND-PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM



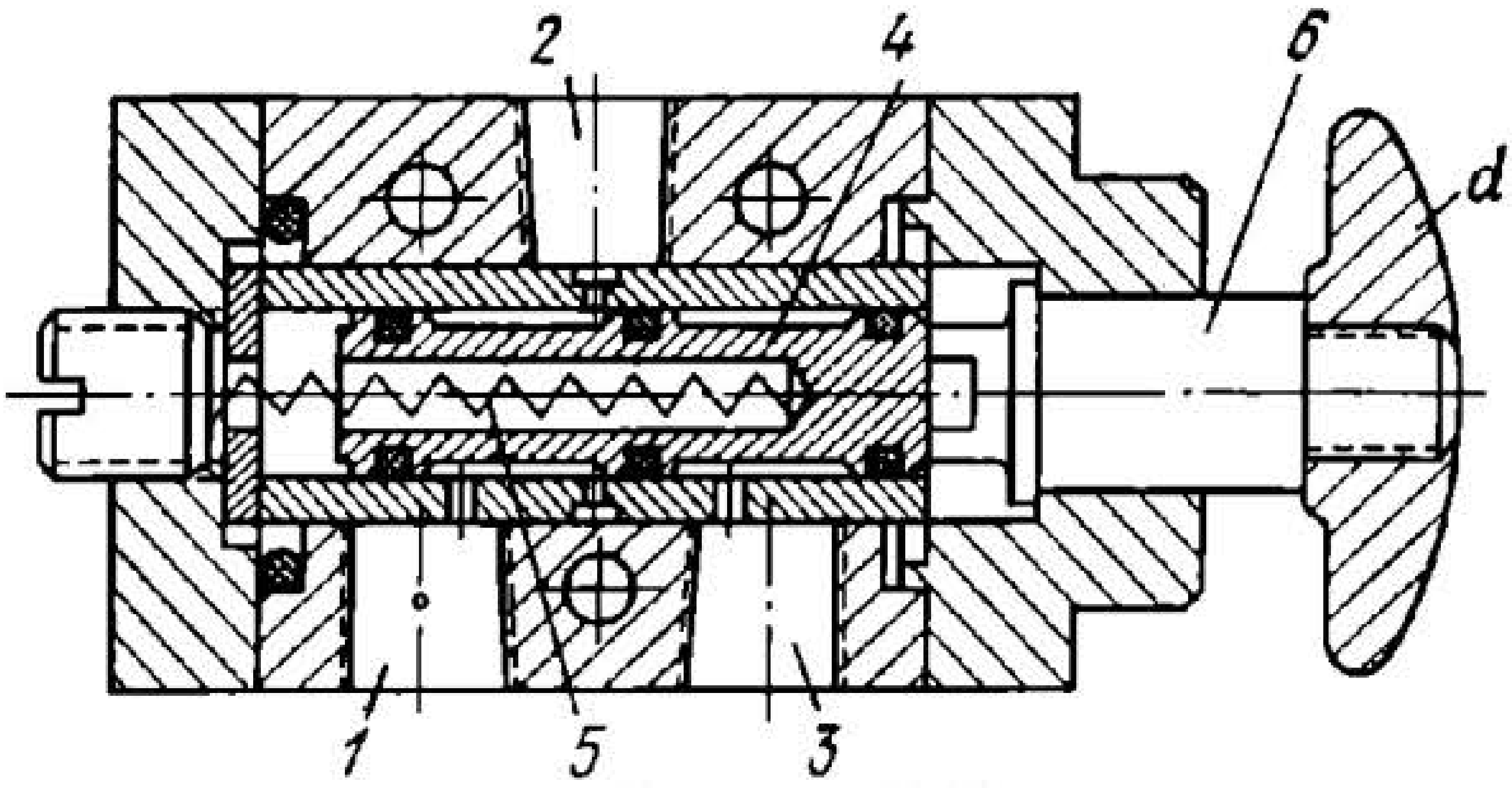
(a)



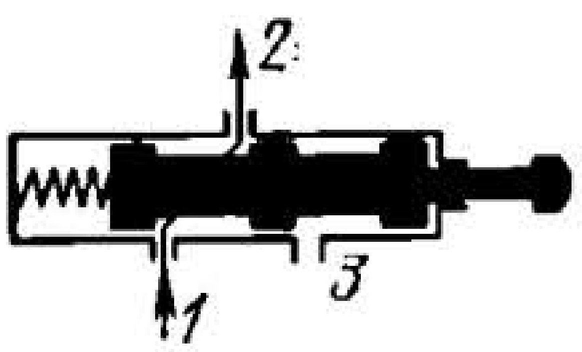
(b) (c)

In the position of spool *5* shown in Fig. *a*, port *1*, supplied by compressed air from the main, is connected to port *2*. Port *3*, connected to the atmosphere, is closed off. When palm button *d* of pusher *6* is pressed, spool *5* is shifted to the left and it blocks port *1*. Port *2* is connected to the atmosphere through port *3*. Spool *5* is returned to its initial position by admitting pilot air through port *4*. The principle of the valve is shown schematically in Figs. *b* and *c*.

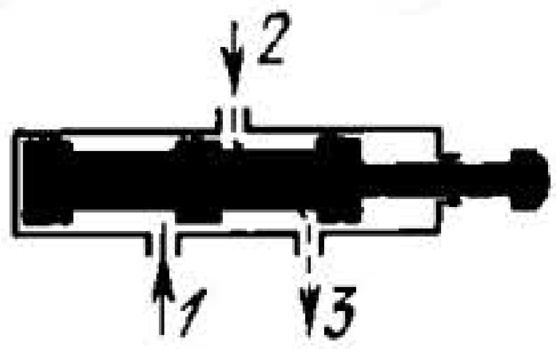
3693	THREE-WAY TWO-POSITION SPOOL-TYPE PALM-BUTTON-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



(a)



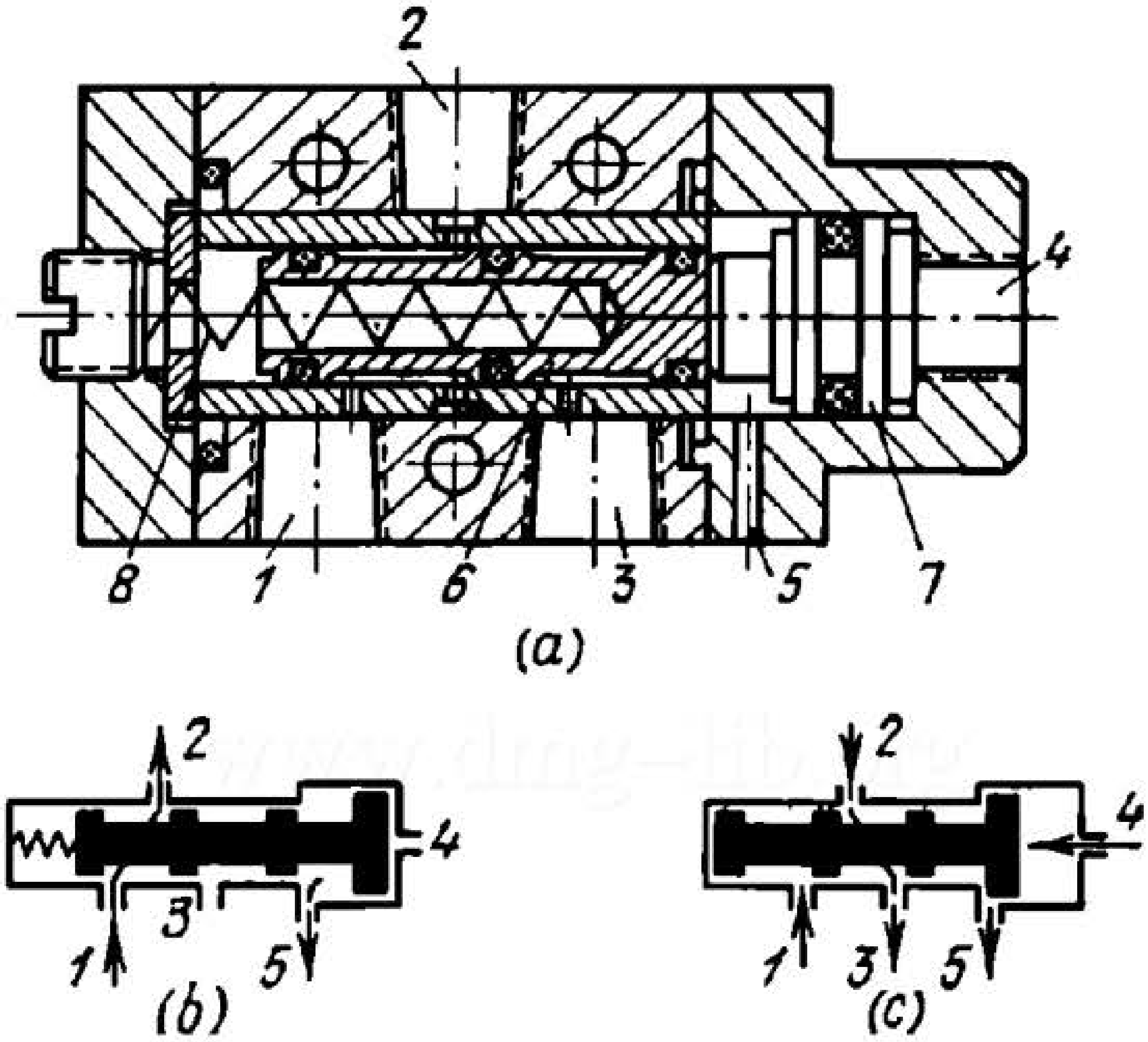
(b)



(c)

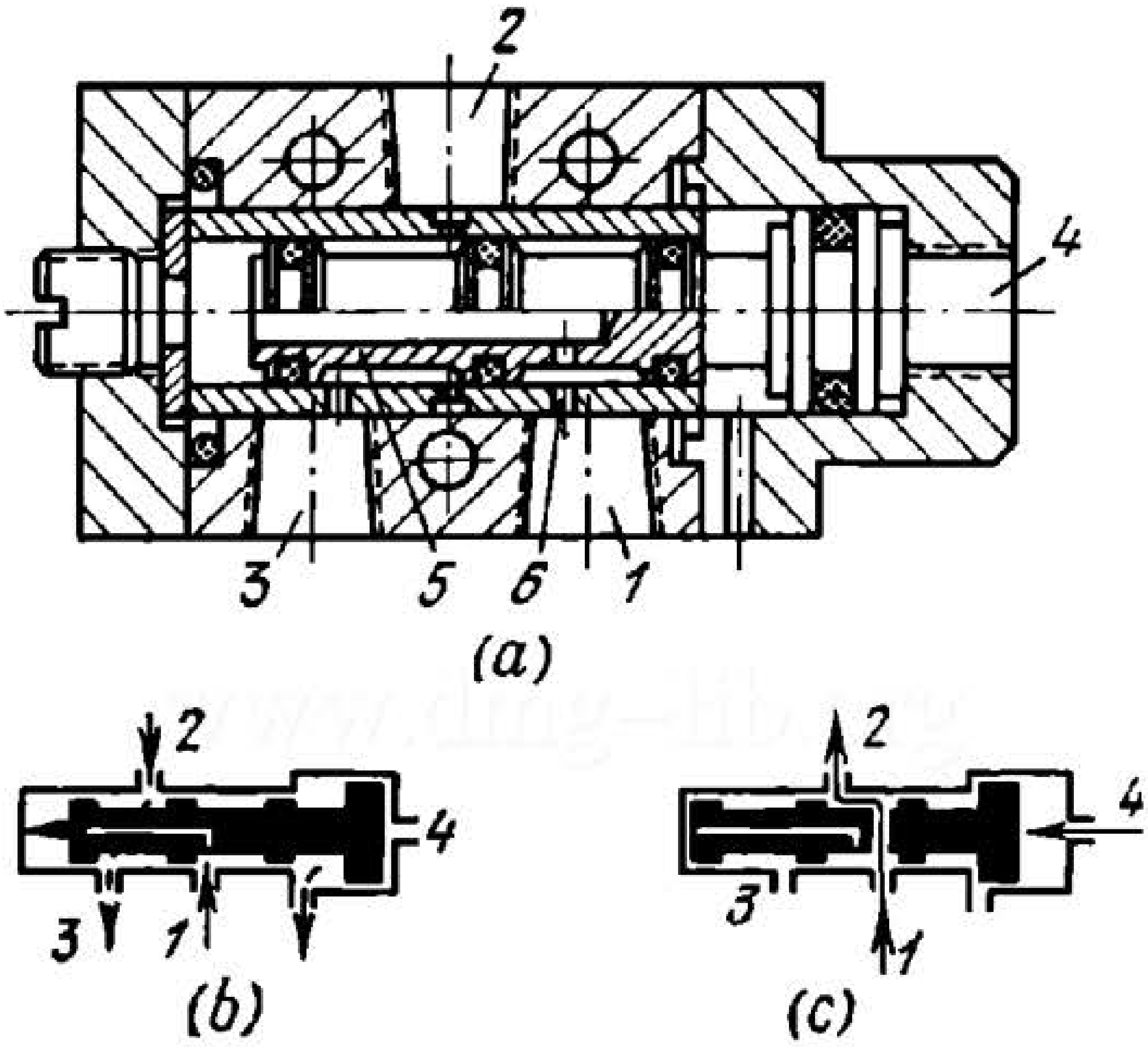
Compressed air, supplied from the main to port *1*, is admitted into port *2* (Fig. *a*.). When palm button *d* of pusher *6* is pressed, spool *4* is shifted to the left and connects port *2* to port *3*, which leads to the atmosphere. When palm button *d* of pusher *6* is released, spool *4* is returned by spring *5* to its initial position. The principle of the valve is shown schematically in Figs. *b* and *c*.

3694	THREE-WAY TWO-POSITION SPOOL-TYPE PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



In the initial position of spool *6*, shown in Fig. *a*, compressed air, supplied from the main to port *1*, is admitted into port *2*. When pilot air is admitted into port *4*, spool *6* is shifted by piston *7* to the left, connecting port *2* to port *3*, which leads to the atmosphere. When port *4* is connected to the atmosphere, spool *6* and piston *7* are returned to the initial position by spring *8*. Channel *5* is connected at all times to the atmosphere. The principle of the valve is shown schematically in Figs. *b* and *c*.

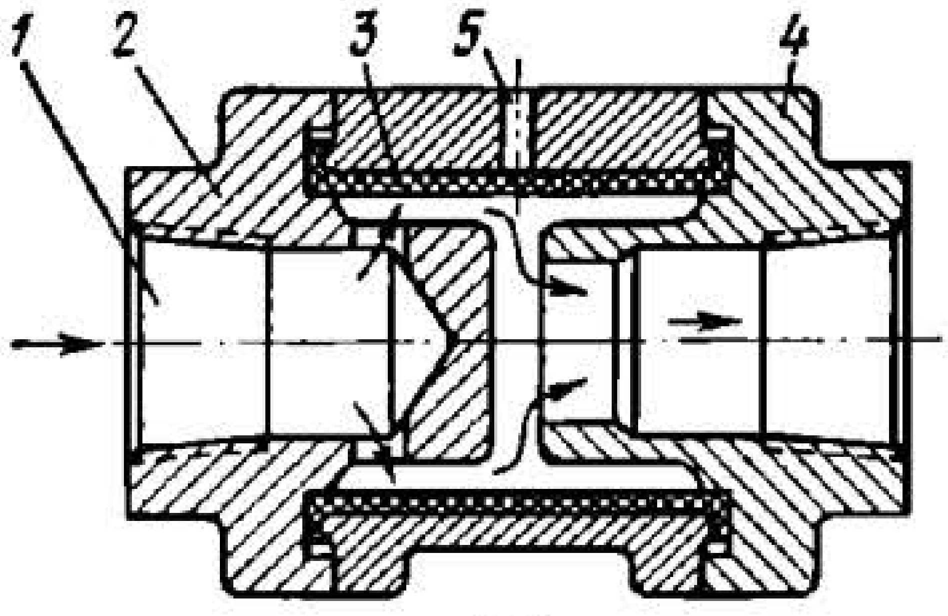
3695	THREE-WAY TWO-POSITION SPOOL-TYPE PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



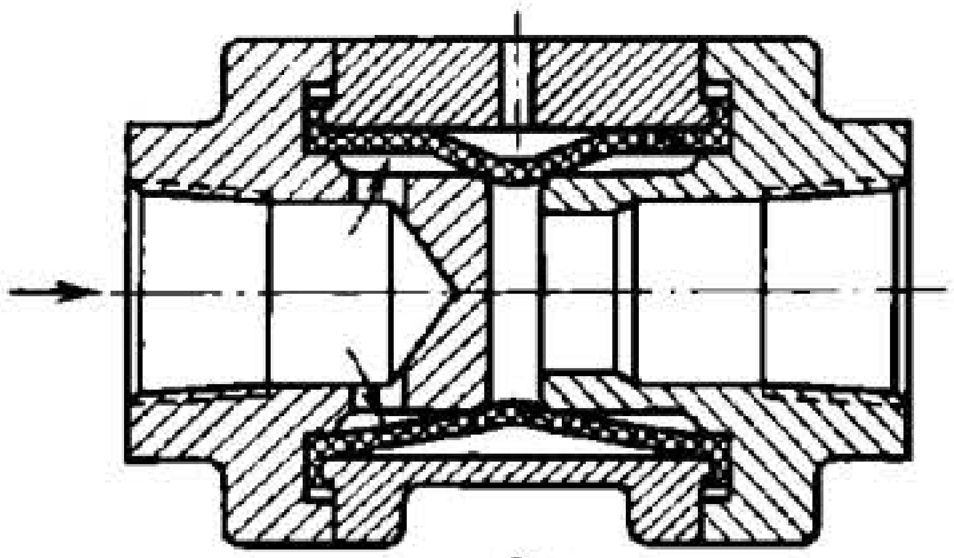
Compressed air, supplied from the main to port *1*, passing through hole *6*, is admitted through the central channel in spool *5* to the left end space of the spool, holding spool *5* in the position shown in Fig. *a*. At this, port *2* is connected to port *3*, which leads to the atmosphere. When pilot air is admitted into port *4*, spool *5* moves to the left because the right end of spool *5* is of greater area than the left end. This connects port *1* to port *2*. The principle of the valve is shown schematically in Figs. *b* and *c*.

3696	TWO-WAY RUBBER-TUBE-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC

Fluid (air or liquid) enters through port *1*, flows through radial passages in member *2* and is discharged through the port in member *4* (Fig. *a*). When pilot (compressed) air is admitted through port *5*, rubber tube *3* is compressed and it blocks the flow of air through the radial passages (Fig. *b*).

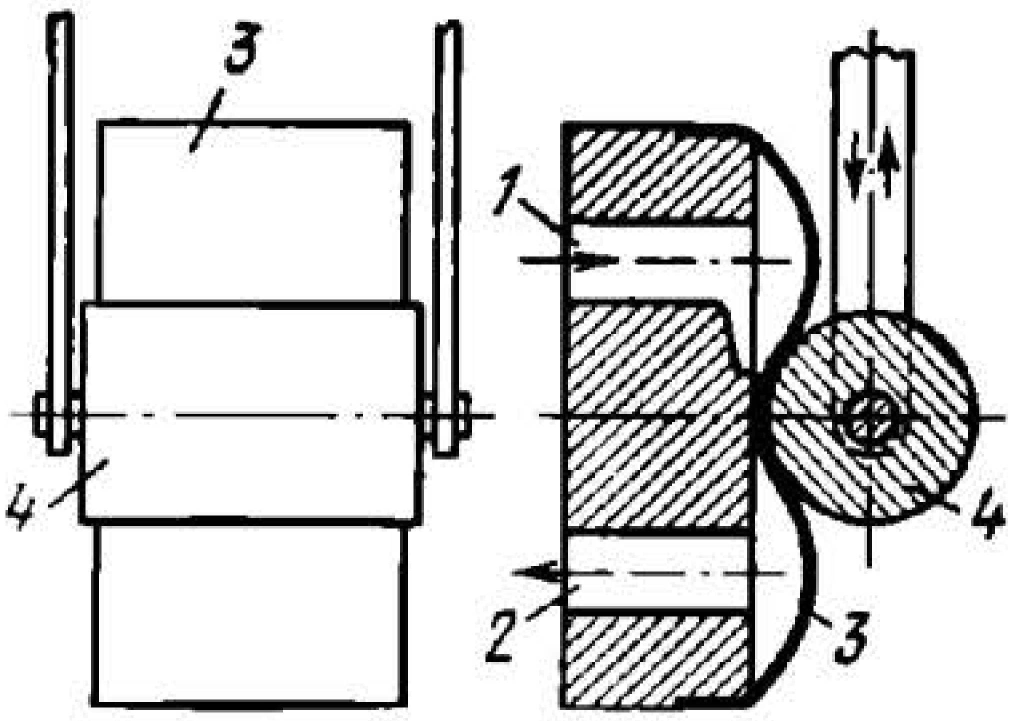


(a)



(b)

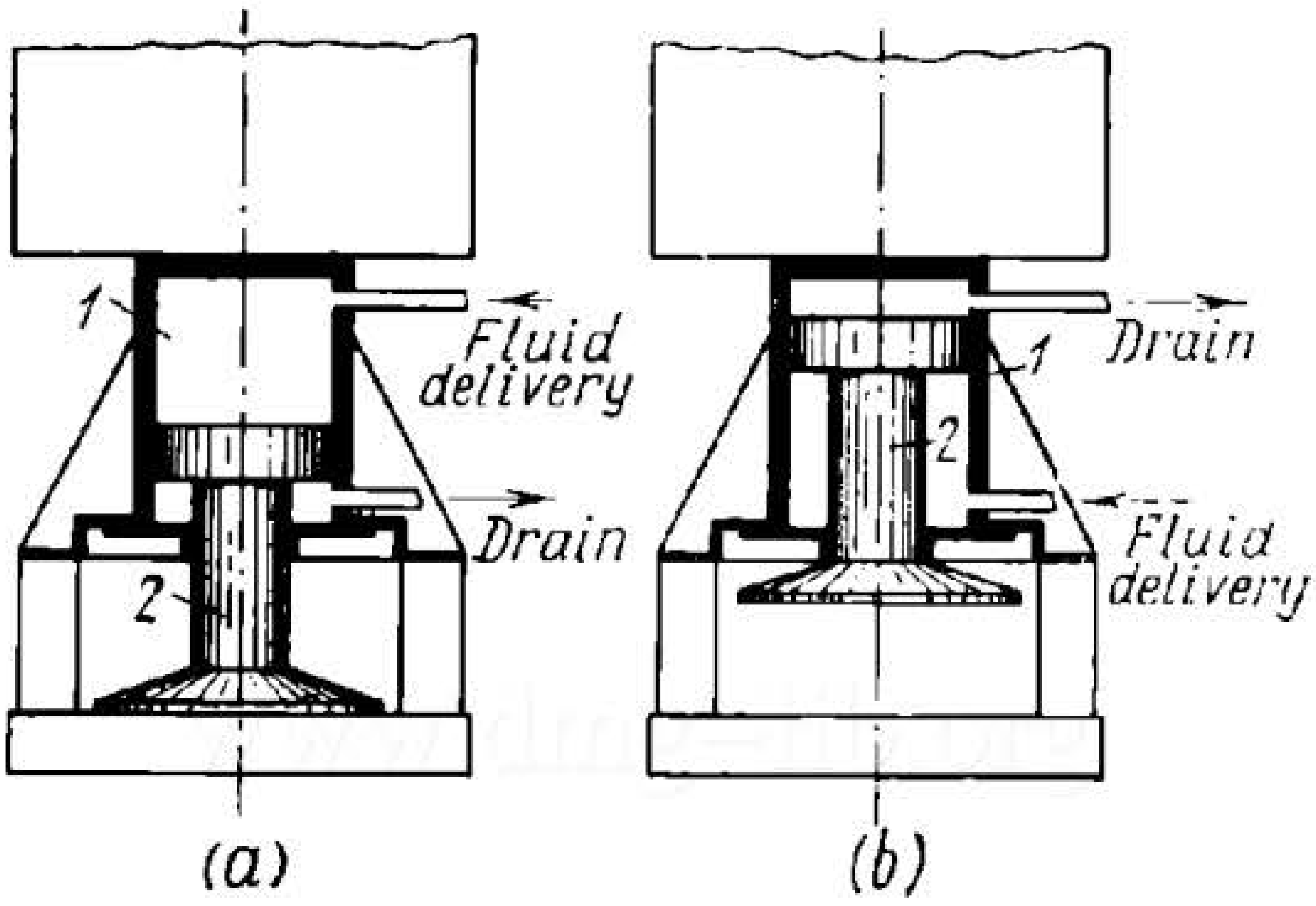
3697	TWO-WAY DIAPHRAGM-TYPE PNEUMATIC DIRECTIONAL VALVE MECHANISM	SHP FC



Compressed air is supplied from the main to port *1*. Depending upon the position of roller *4*, rolling along diaphragm *3*, port *1* is either blocked or the air passes into port *2*. The rate of air flow is determined by the vertical position of roller *4*, which deforms diaphragm *3*.

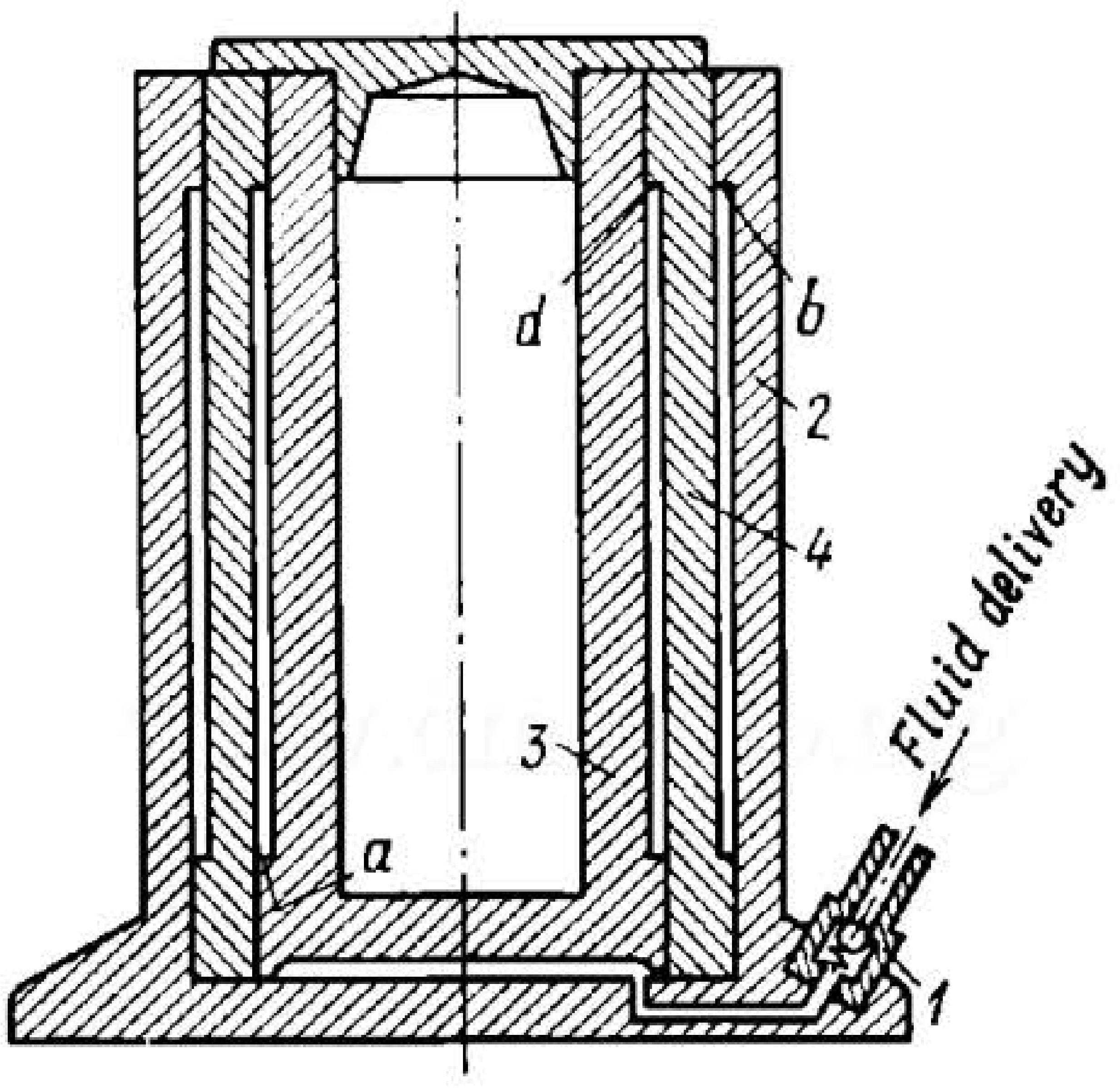
4. MECHANISMS OF MATERIALS HANDLING EQUIPMENT (3698, 3699 and 3700)

3698	DOUBLE-ACTING HYDRAULIC JACK MECHANISM	SHP MH

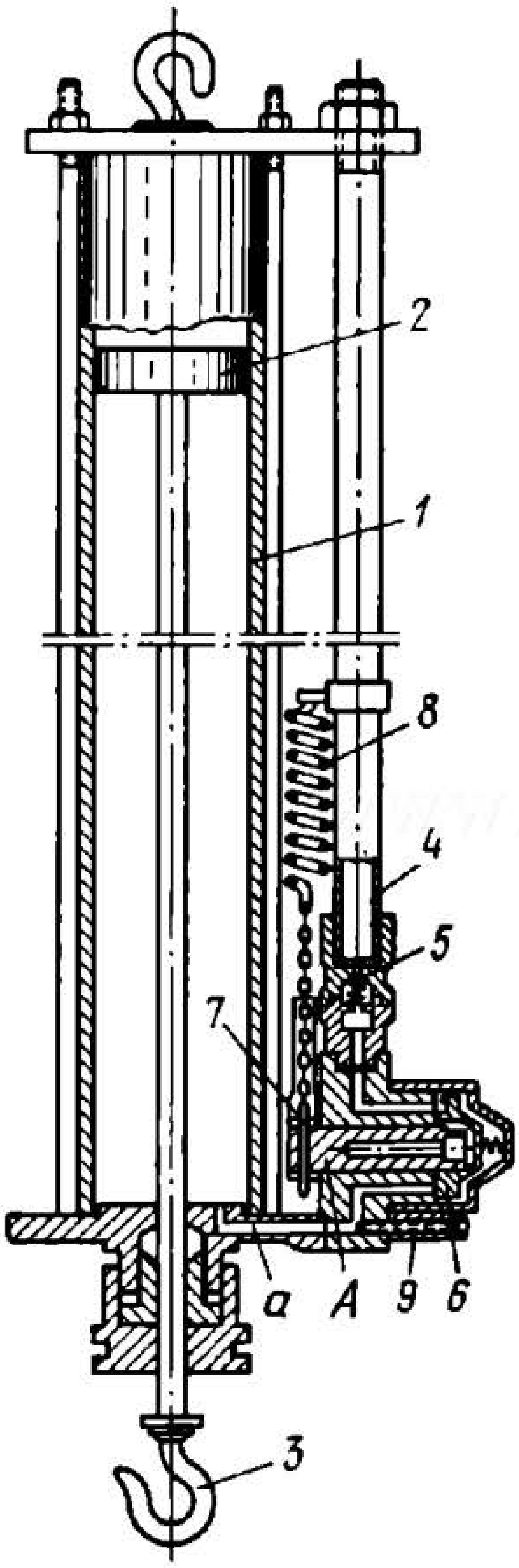


Both cylinder *1* and piston *2* of the jack can travel. First piston *2* is placed on a support (Fig. *a*) and fluid is admitted into the upper end of cylinder *1*, which is raised together with the load. When the cylinder reaches its extreme upper position, supporting beams of equal height are placed under the feet of the cylinder and fluid is admitted into the lower end of the cylinder. This retracts piston *2* into the cylinder and, when it reaches its extreme upper position, supporting beams are placed under the piston, repeating the process as required.

3699	HYDRAULIC TELESCOPE JACK MECHANISM	SHP MH



Fluid delivered through ball-type check valve *1* enters the lower end of cylinder *2*. This lifts plunger *3* until its external shoulder *a* engages internal shoulder *d* of hollow plunger *4*. Next, both plungers are lifted until the external shoulder of plunger *4* engages internal shoulder *b* of cylinder *2*. This is the limiting position in height.

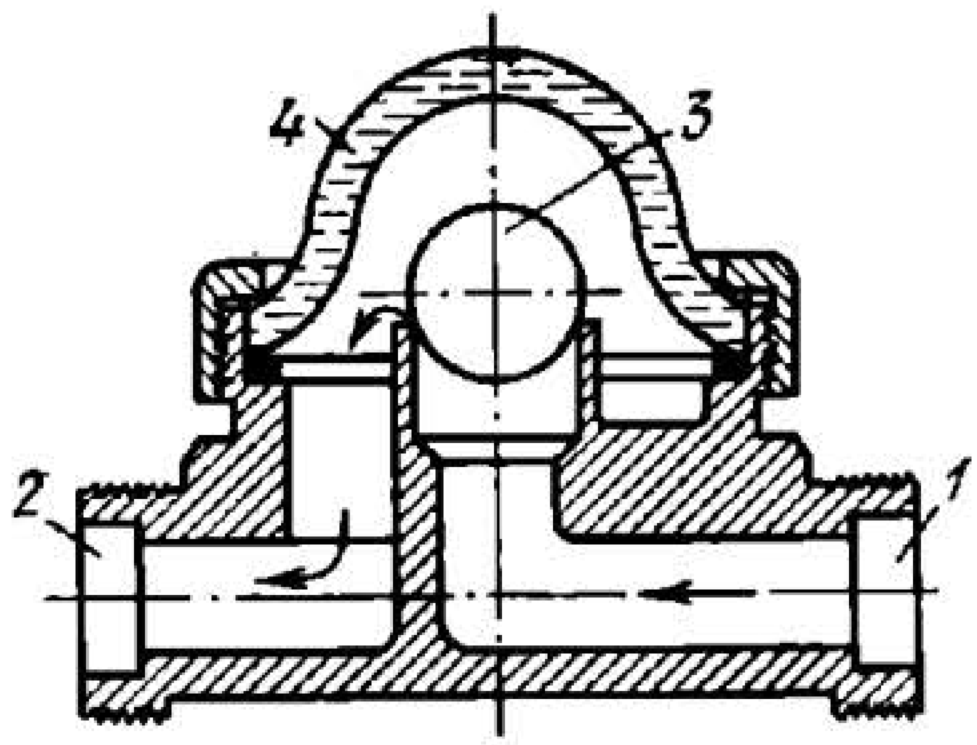


When compressed air is admitted into the lower end of cylinder *1*, piston *2*, to which load hook *3* is attached, travels upward. When the lower end of cylinder *1* is connected to the atmosphere, piston *2* is lowered by gravity. Air is delivered to the lower end of cylinder *1* through pipeline *4*, opening check valve *5*, and through rotary valve *6* and channel *a*. Valve *6* is controlled by two chains which are attached to the ends of control lever *7*. Lever *7* is mounted on one end of shaft *A* with the valve member on the other end. The valve member is spring-loaded. Thus, the lower end of cylinder *1* can be connected either to the compressed air main or to the atmosphere. Spring *8* holds control lever *7* in the position in which the lower end of the cylinder is closed off. In case of damage to the pipeline or other failure of the compressed air supply, the pressure above check valve *5* drops and this valve blocks reverse flow of compressed air out of the cylinder, thereby preventing the dropping of the load. The speed at which the load is lowered in normal operation can be regulated by adjusting screw *9* which changes the rate of flow of air from under piston *2*.

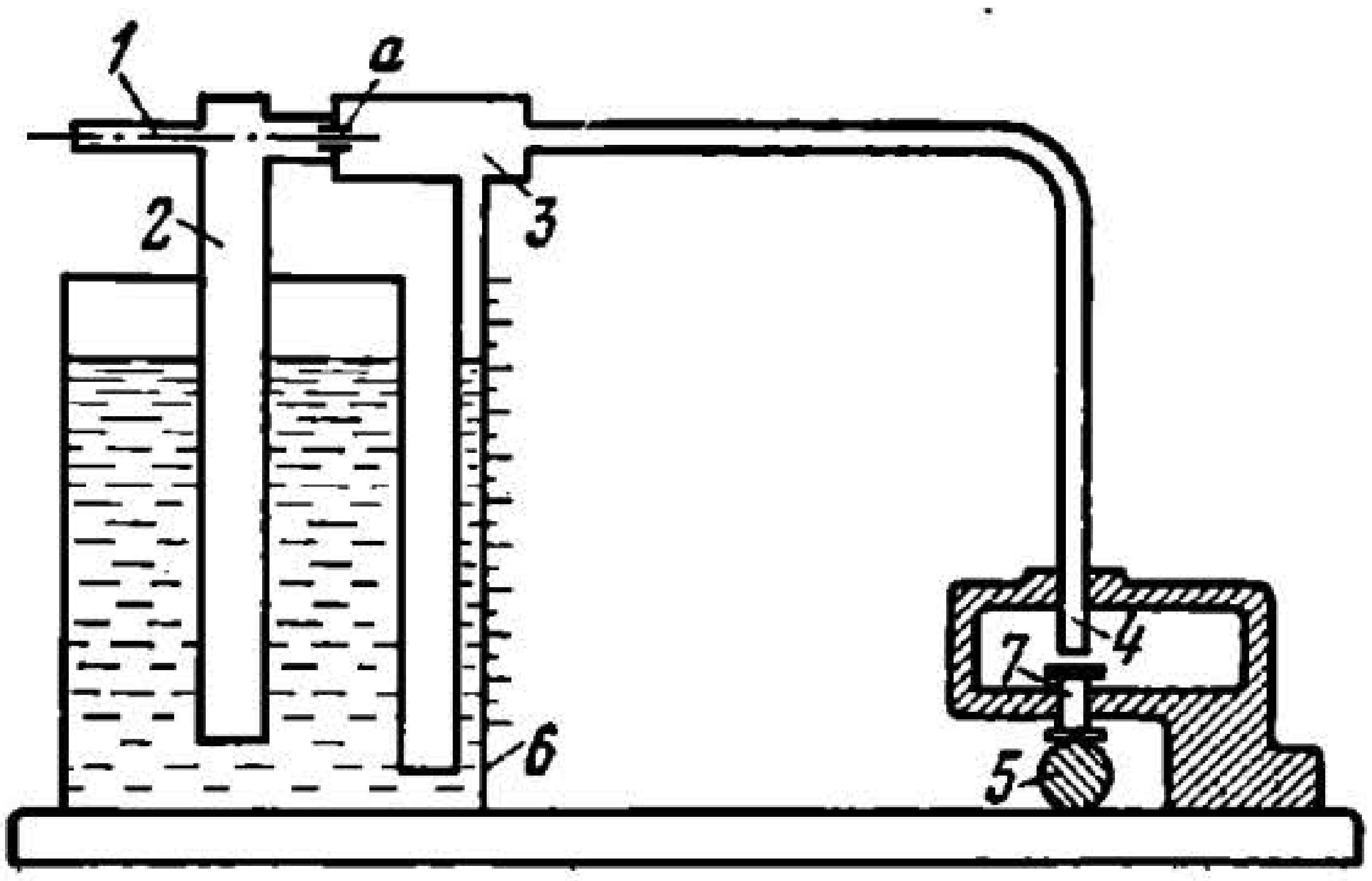
5. MECHANISMS OF MEASURING AND TESTING DEVICES (3701 through 3737)

3701	FLOW DETECTOR MECHANISM	SHP M

When compressed fluid (air or liquid) is admitted into port *1*, ball *3* is thrown upward by the action of the fluid stream and the fluid is discharged through port *2*. The ball remains in its upper position as long as the flow of fluid continues. The position of the ball can be observed through cap *4* which is made of transparent plexiglas.

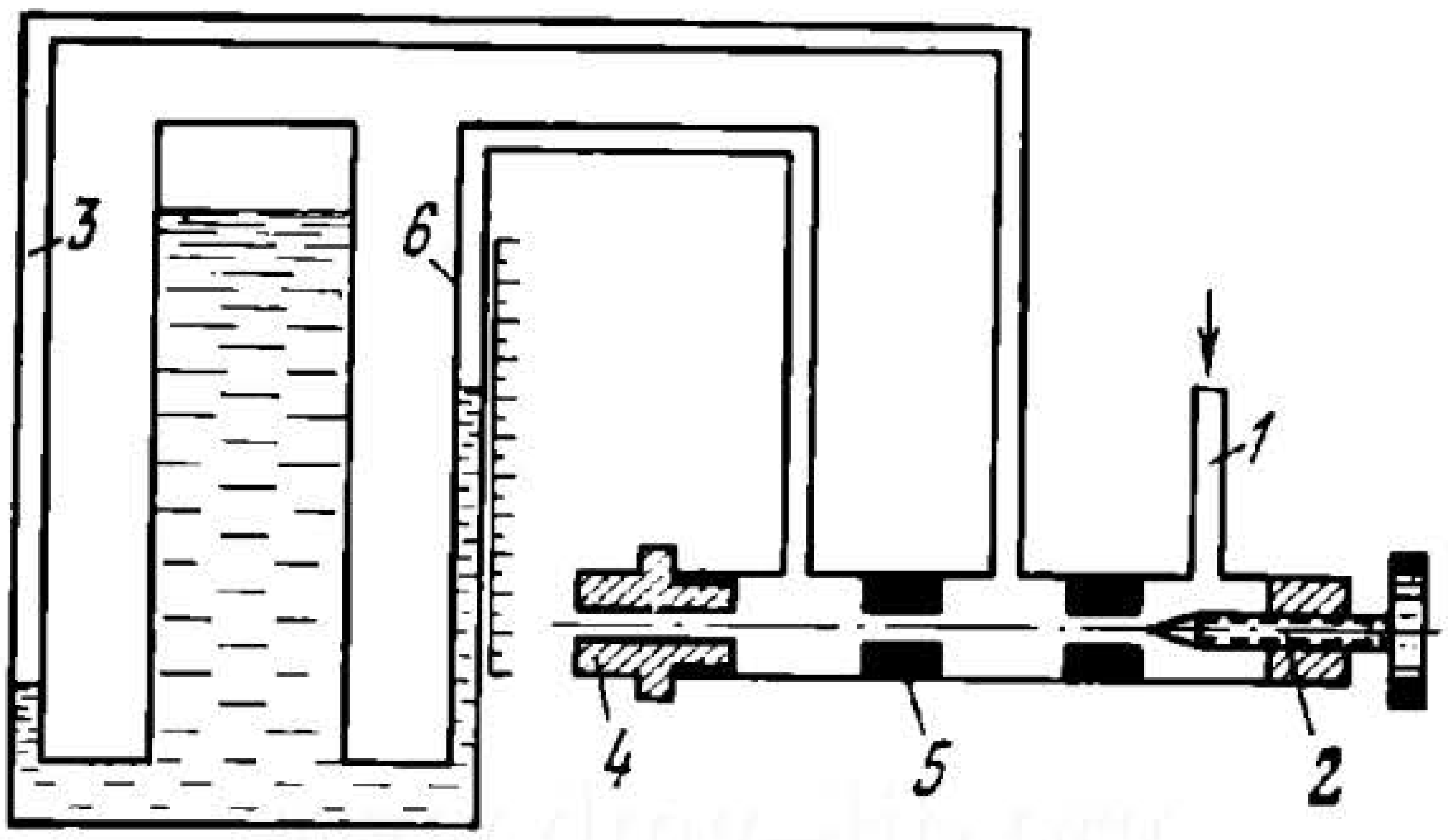


3702	WATER-COLUMN BACK-PRESSURE PNEUMATIC GAUGE MECHANISM FOR CONTACT MEASUREMENT	SHP M



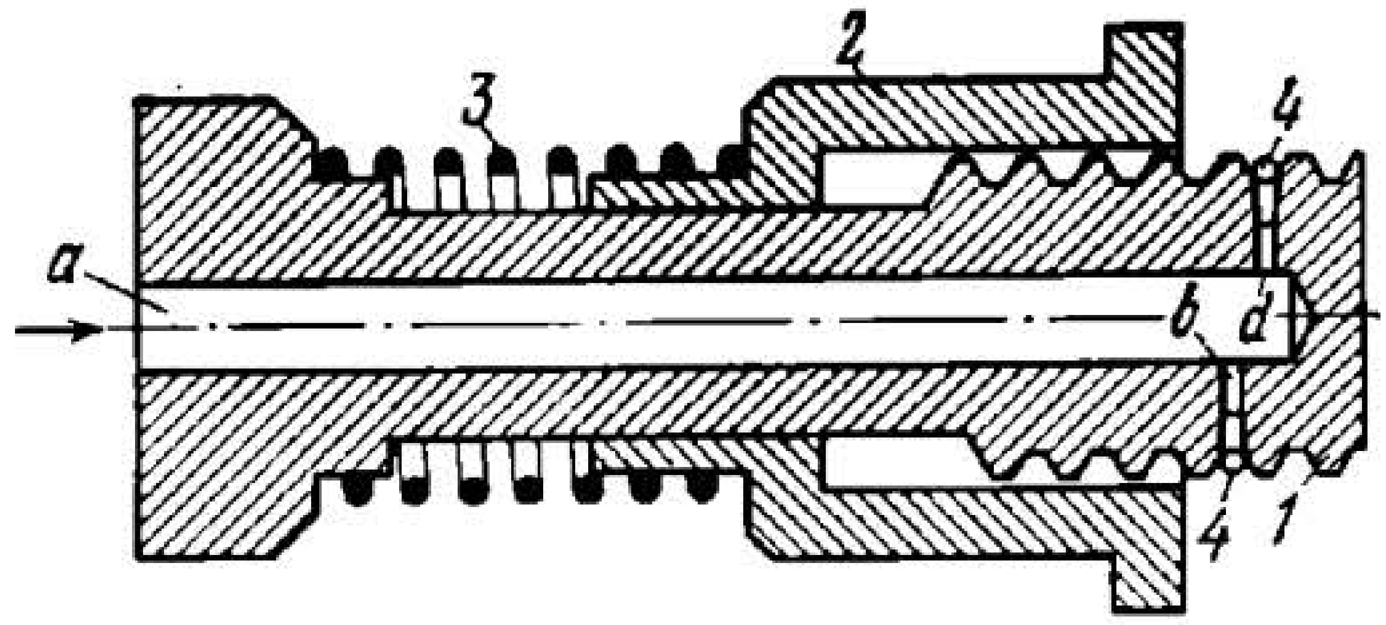
Compressed air is supplied from the main through pipeline *1* and partly enters tube *2*, immersed in water and used as a pressure stabilizer, and partly passes through restrictor *a* into measuring chamber *3*. From the measuring chamber, air is admitted through nozzle *4*. The work being checked is placed under contact tip *7*. Depending upon the clearance between the nozzle and the flat head of the contact tip, a definite pressure is established in measuring chamber *3*. This pressure is measured by water-column pressure gauge (manometer) *6*. This pressure indicates whether the work is within the required limits of size.

3703	WATER-COLUMN BACK-PRESSURE PNEUMATIC GAUGE MECHANISM FOR DIRECT HOLE MEASUREMENT	SHP M



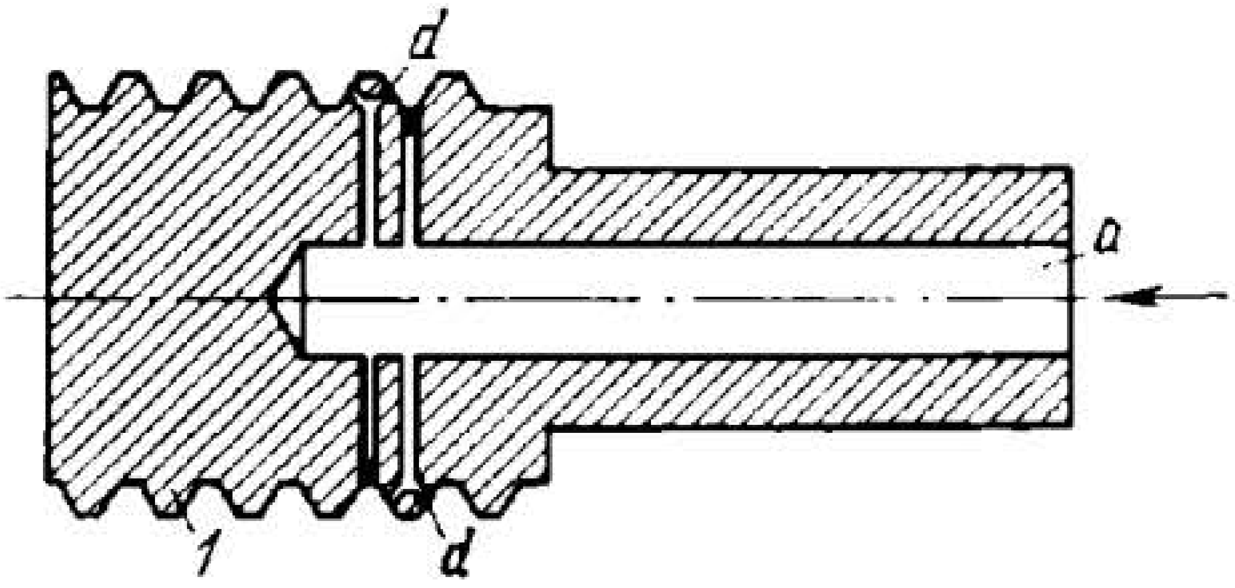
Compressed air is supplied from the main along pipeline *1* through needle flow-control valve *2*, which establishes the working pressure measured by manometer *3*. Flow-control valve *2* is adjustable in order to compensate for drops in pressure due to increased air consumption. Entrance nozzle, or restrictor, *5* is taken to correspond to the diameter of the hole to be checked in work *4*. The pressure measured by manometer *6* varies in accordance with the actual size of the hole in work *4*. The scale of manometer *6* can be graduated into units that show the deviation of the hole size from the basic value.

3704	GORODETSKY PNEUMATIC THREAD GAUGE MECHANISM	SHP M



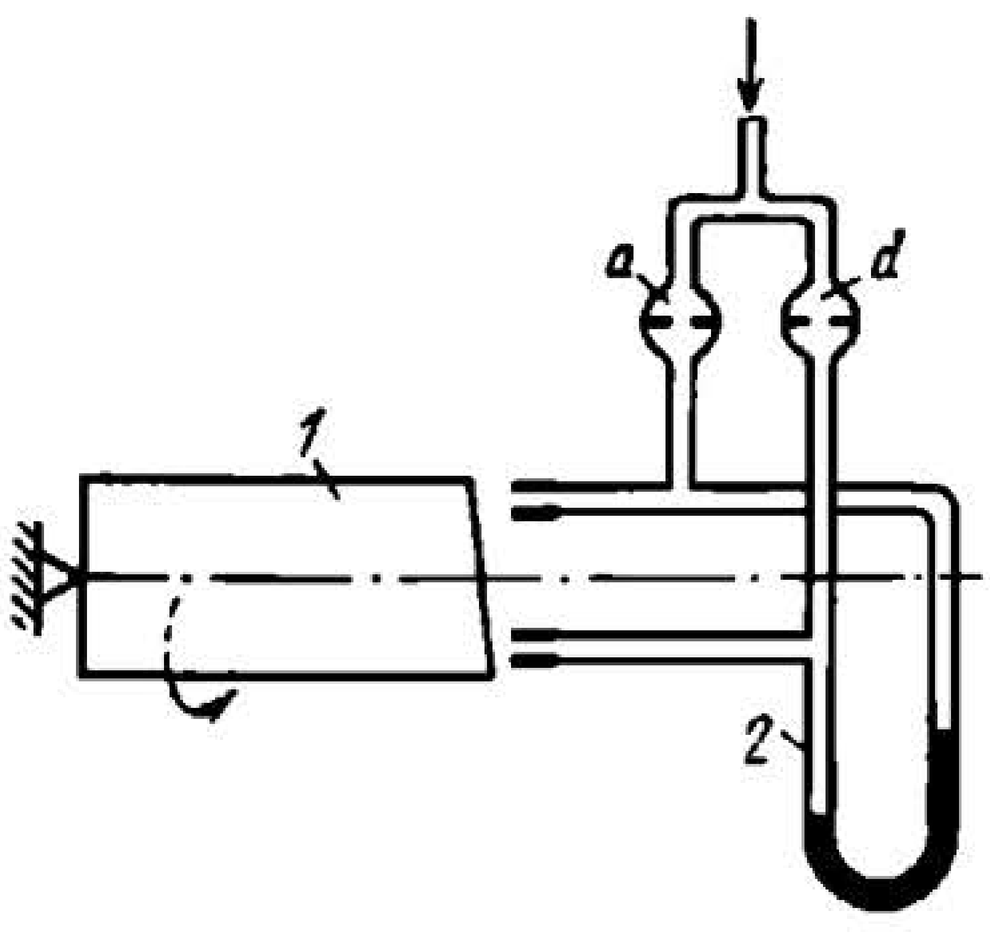
Compressed air is delivered from the measuring chamber of a back-pressure gauging system and passes along channel *a* of gauging plug *1* to radial orifices *d* and *b*. These orifices taper outward at their outer ends. Placed into these taper holes are steel balls *4* of a diameter close or equal to the most expedient diameter of the wires used in the three-wire method of measuring thread pitch diameters for the given pitch. The diameter of the cylindrical part of the orifices should be less than the diameter of the steel balls to prevent their dropping into channel *a*. The balls are kept from dropping out when the gauge is not in operation by sleeve *2*, which is pushed over the gauge by spring *3*. During the inspection of a threaded hole, the gauge is screwed into the hole in the work and the sleeve is held by the spring against the end face of the threaded hole. The pressure of the compressed air pushes balls *4* into the internal thread being checked. The clearance between the balls and the tapered holes depends on the actual size of the pitch diameter being checked and this determines the air flow which is indicated by the pneumatic back-pressure gauging system.

3705	**GORODETSKY PNEUMATIC THREAD GAUGE MECHANISM**	SHP M



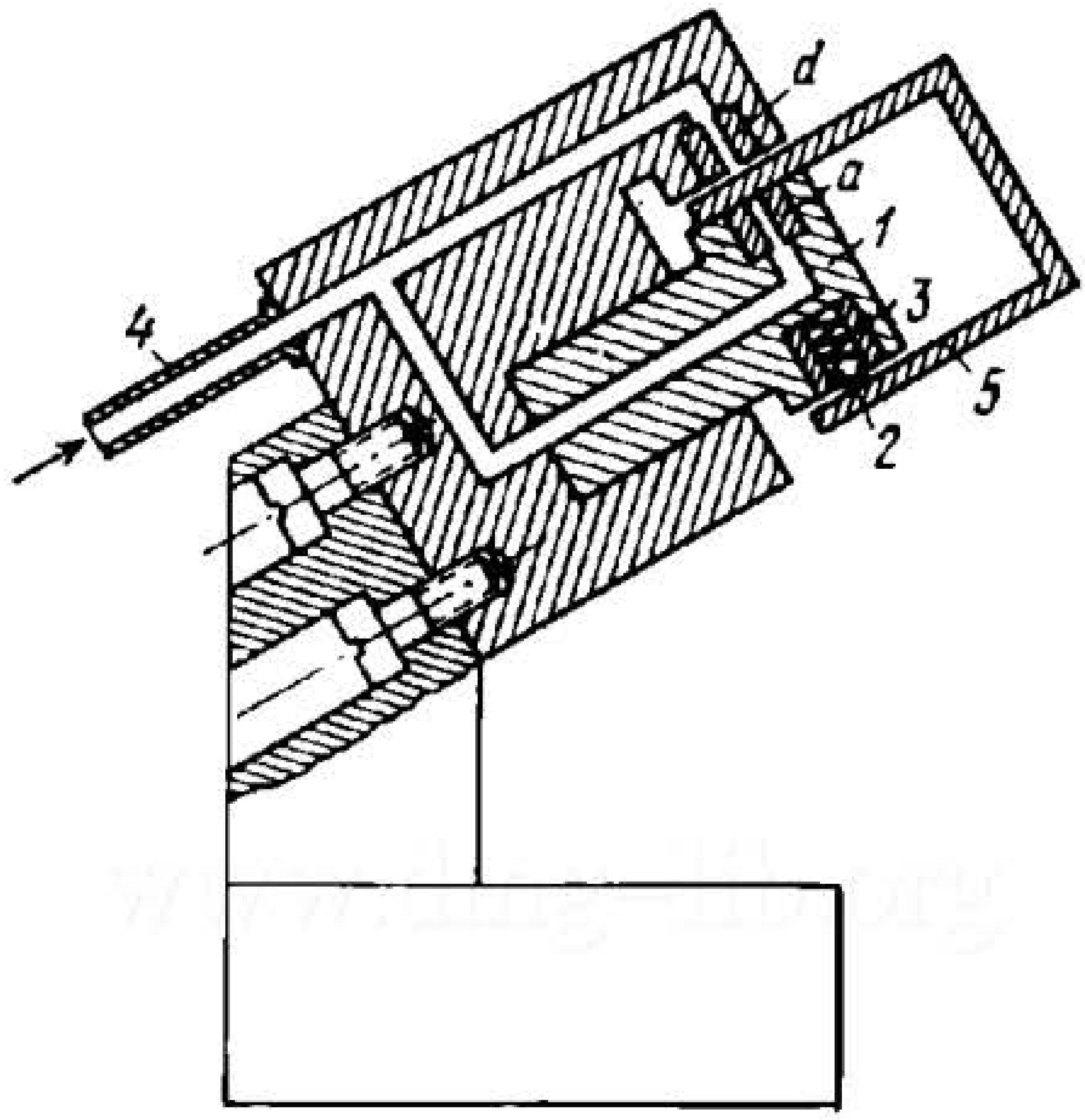
Compressed air is delivered through the restrictor into the measuring chamber of a back-pressure gauging system and then passes through channel *a* to four measuring orifices *d* arranged in pairs at the opposite threads of gauging plug *1*. The outlets *d* of the orifices are at the middle of the thread profiles. The provision of four orifice outlets keeps the measured results independent of displacements of the plug in the radial and axial directions. The pressure gauge of the system indicates the magnitude of the clearance between the gauging plug and internal thread being checked at the points where the measuring orifices are located.

3706	**PNEUMATIC GAUGING INSTRUMENT MECHANISM FOR CHECKING END FACE SQUARENESS**	SHP M



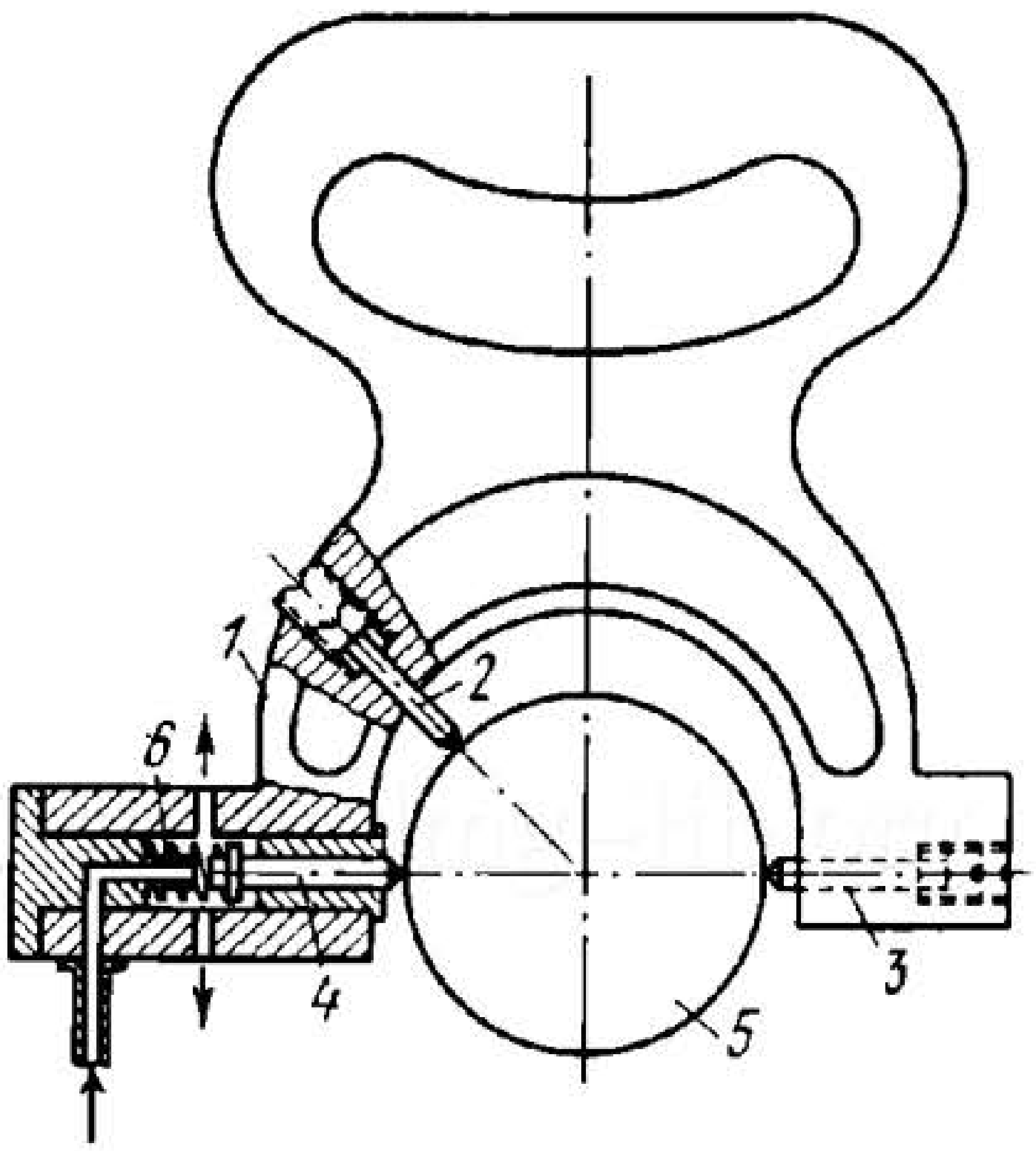
Squareness of the end face of work *1* to its axis is checked by using differential manometer *2*. Compressed air is delivered through restrictors *a* and *d* to the gauging nozzles of the measuring heads. For each position of work *1*, the clearances between its end face and the nozzles determine the heights of the mercury columns in the two branches of differential manometer *2*. If the end face is square to the axis of the work, the mercury levels in the two branches of the manometer will be the same when the work is slowly rotated.

3707	PNEUMATIC GAUGING FIXTURE MECHANISM FOR CHECKING CONCENTRICITY OF EXTERNAL AND INTERNAL DIAMETERS	SHP M



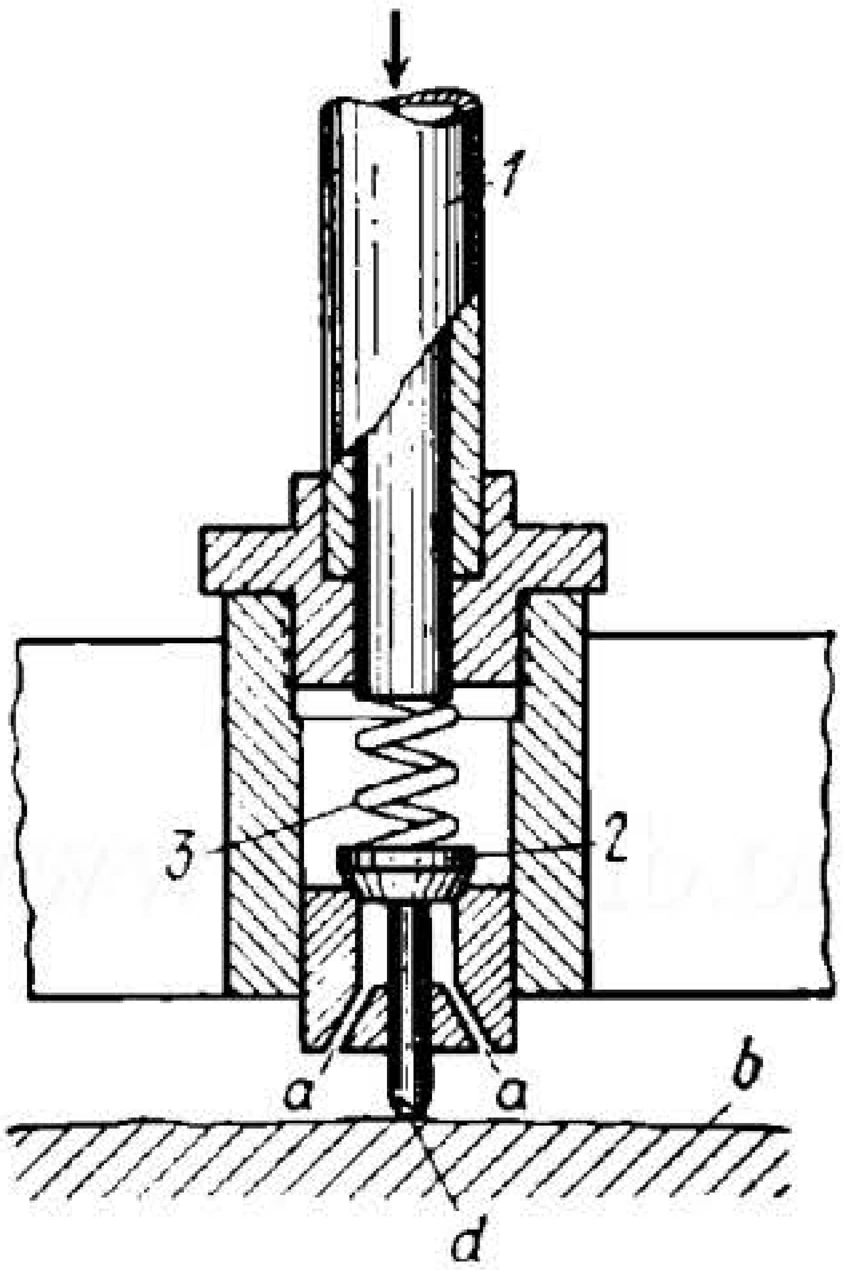
Work *5* of cylindrical shape, to be checked, is placed over the outer end of plug *1*. Ball *2*, actuated by spring *3*, locates the work against the outer surface of plug *1*. Nozzle *a* in the plug is connected by channels to connection *4*. Second nozzle *d* is provided in the body of the gauge. The wall of work *5* being checked is confined between the two nozzles to which compressed air is delivered through connection *4* from a back-pressure gauging system. According to the clearances between the nozzles and the wall, a pressure, measured by a manometer, is established in the gauging system. This indicates the wall thickness. Work *5* is turned about the axis of plug *2* to determine the differences in thickness of the wall and, consequently, the lack of concentricity of the internal and external surfaces of work *5*.

3708	PNEUMATIC SNAP GAUGE MECHANISM	SHP M



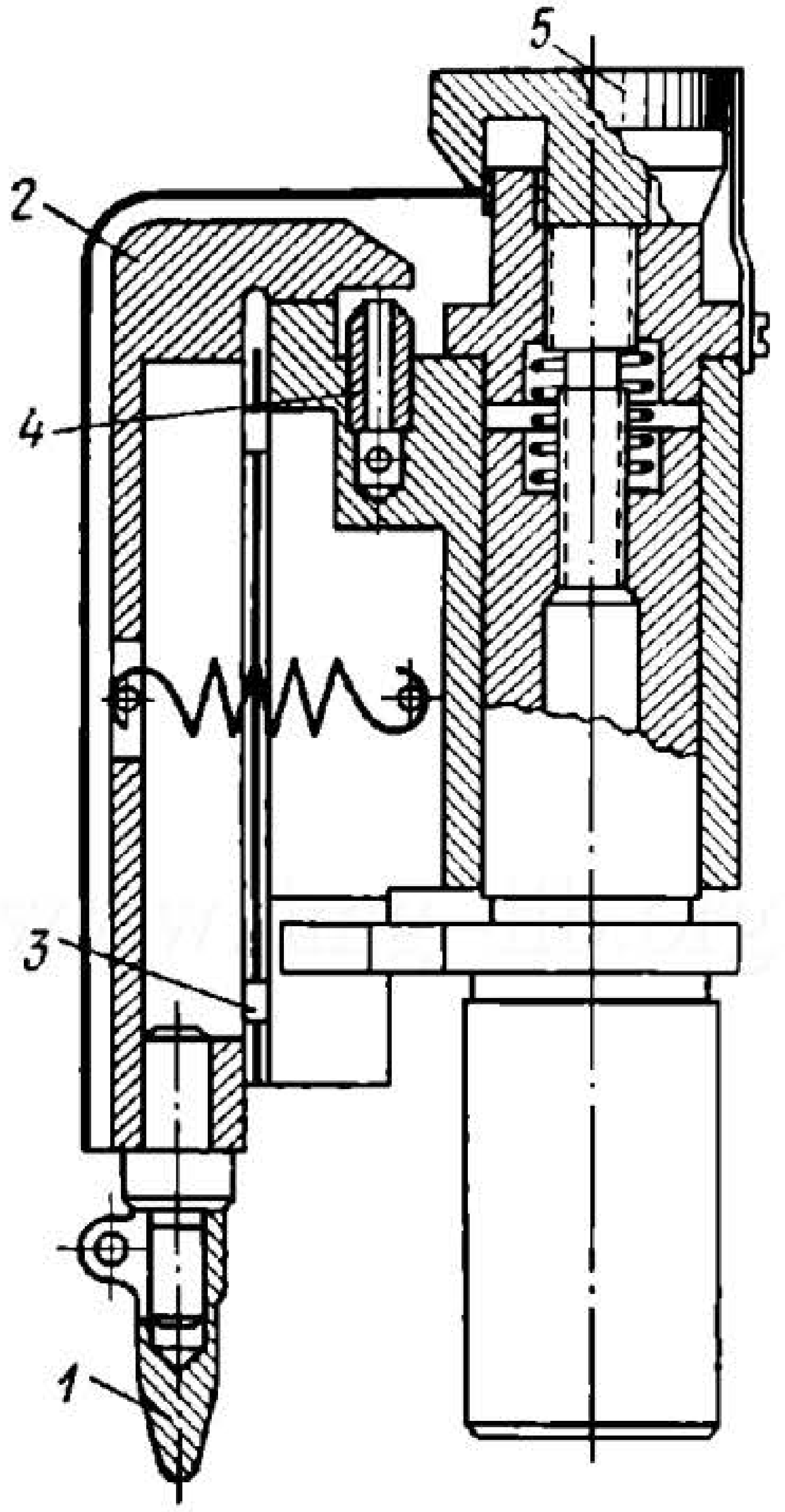
Installed in the body of snap gauge *1* are three pins: fixed backstop *2* and gauging anvil *3*, and movable anvil *4*. The movable anvil is actuated by the deviations in the diameter of work *5*, which contacts the outer ends of the three pins. A definite clearance is set up between the rear end of movable anvil (pin) *4* and nozzle *6*, to which compressed air is delivered, to suit the nominal size of work *5*. The variation in clearance affects the air pressure in the system. This pressure is measured by a pressure gauge which thereby indicates the deviations in the size of the work. The positions of pins *2* and *3* are adjustable with setscrews.

3709	PNEUMATIC STYLUS MECHANISM FOR SURFACE ROUGHNESS MEASUREMENT	SHP M



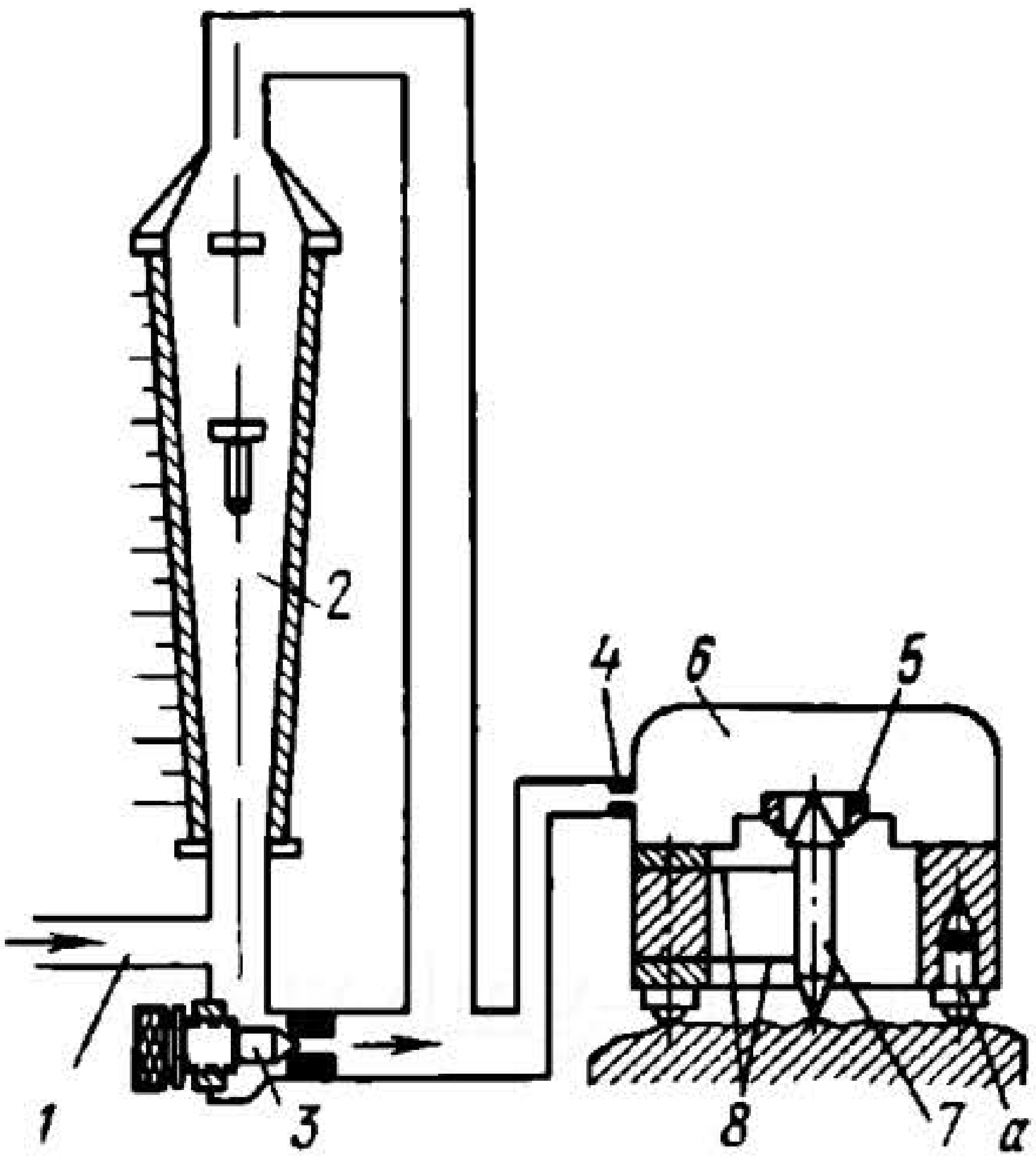
Compressed air is delivered through pipe *1* and past valve *2* to channels *a*. As stylus *d*, held by spring *3* against surface *b* whose roughness is being measured, slides along surface *b*, the irregularities of surface *b* raise and lower the stylus and valve *2*, varying the flow of compressed air in the system and its pressure. This pressure is continuously measured by a manometer.

3710	PNEUMATIC MEASURING HEAD MECHANISM	SHP M



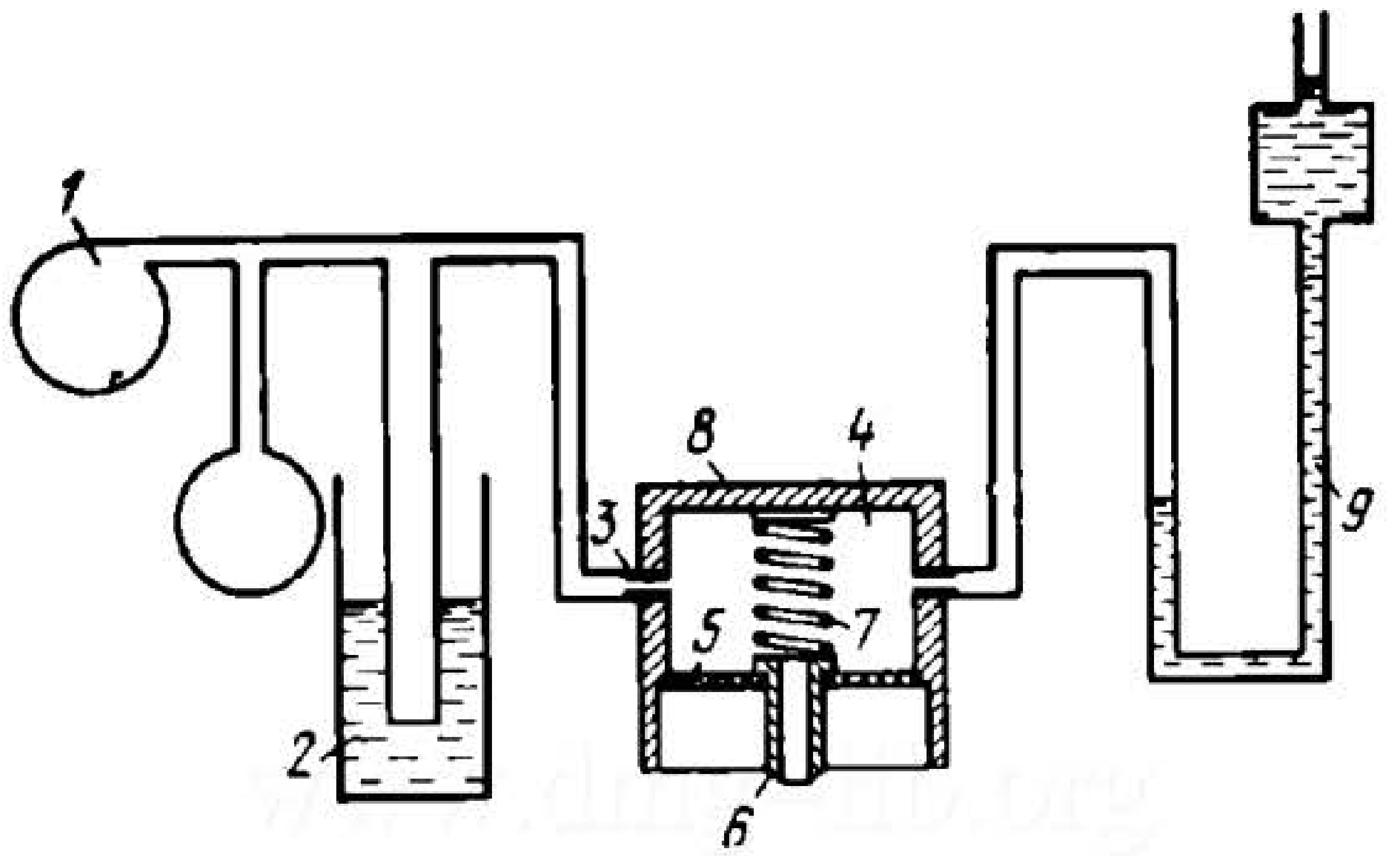
Contact point *1*, which contacts the surface of the work being checked, raises and lowers slider *2* which travels vertically along supports *3*. This changes the clearance between the upper lug of the slider and the face of nozzle *4* to which compressed air is delivered. This, in turn, varies the air pressure in the system which is registered by a manometer. Screw *5* serves to set the contact point to the specified size of the work.

3711	PNEUMATIC FLOW-GAUGE PROFILOMETER MECHANISM FOR SURFACE ROUGHNESS MEASUREMENT	SHP M



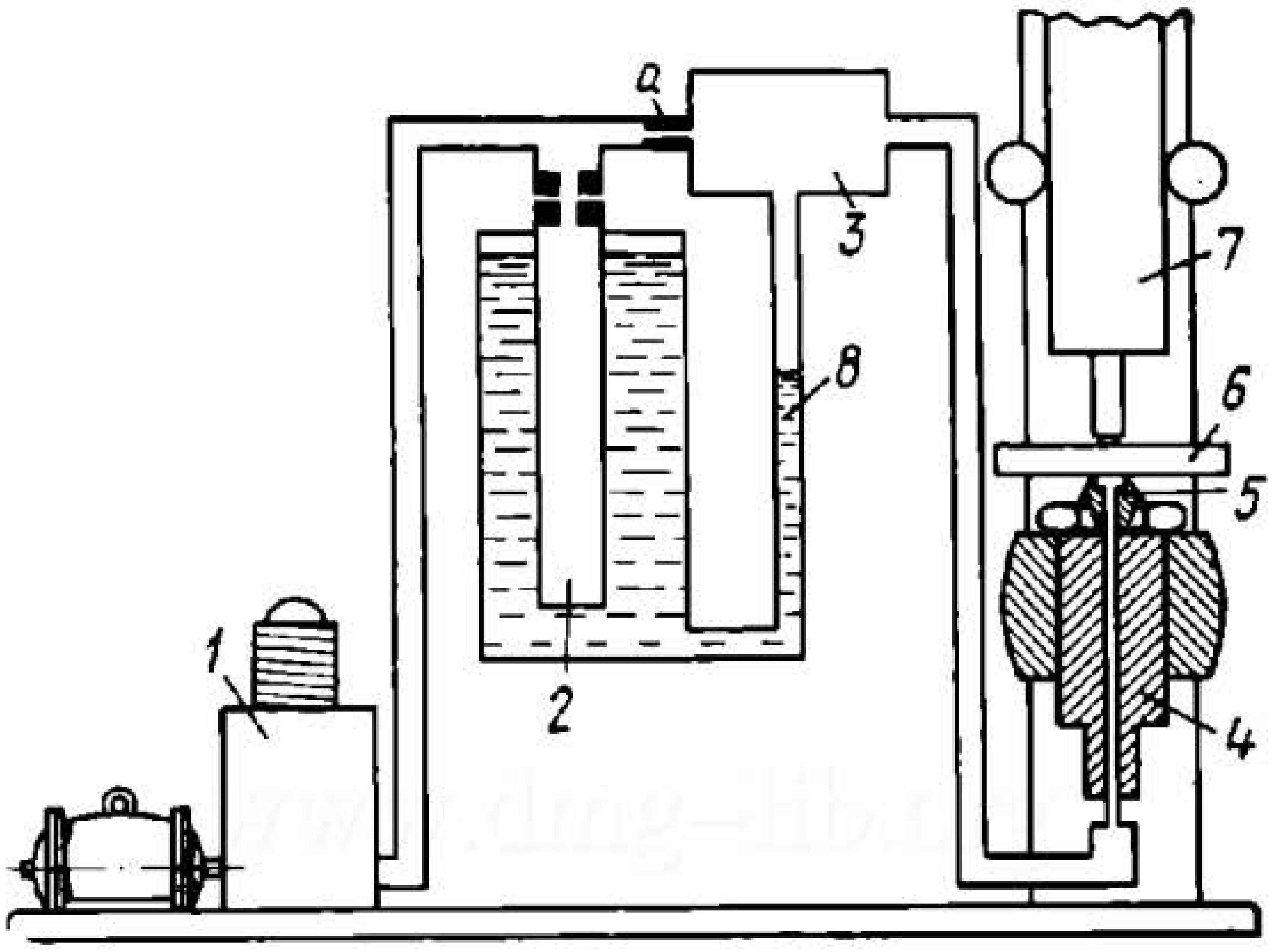
Compressed air is delivered through tube *1*, partly to internally tapered glass indicator column *2* and partly through conical valve *3*. After this the air passes through orifice *4* and chamber *6* to nozzle *5* of the measuring head or tracer. The head consists of stylus *7* mounted on flat steel reeds *8*. The upper end of the stylus is a valve controlling the flow of air from nozzle *5*. In operation, the tracer is placed with its fixed pins *a* on the surface whose roughness is to be measured and is moved along the surface at a definite speed. At this, stylus *7* oscillates vertically in accordance with the irregularities of the surface. This continuously varies the flow of air through orifice *4*. For a high enough frequency of oscillations of the stylus and also for a properly chosen volume of chamber *6* and diameter of orifice *4*, the indicator float in the flow gauge is damped and maintains a position corresponding to the average value of air flow. This is an indication of the average height of surface irregularities.

3712	LINNICK PNEUMATIC INSTRUMENT MECHANISM FOR MEASURING THE DEPTH OF SURFACE IRREGULARITIES IN GRINDING GLASS	SHP M



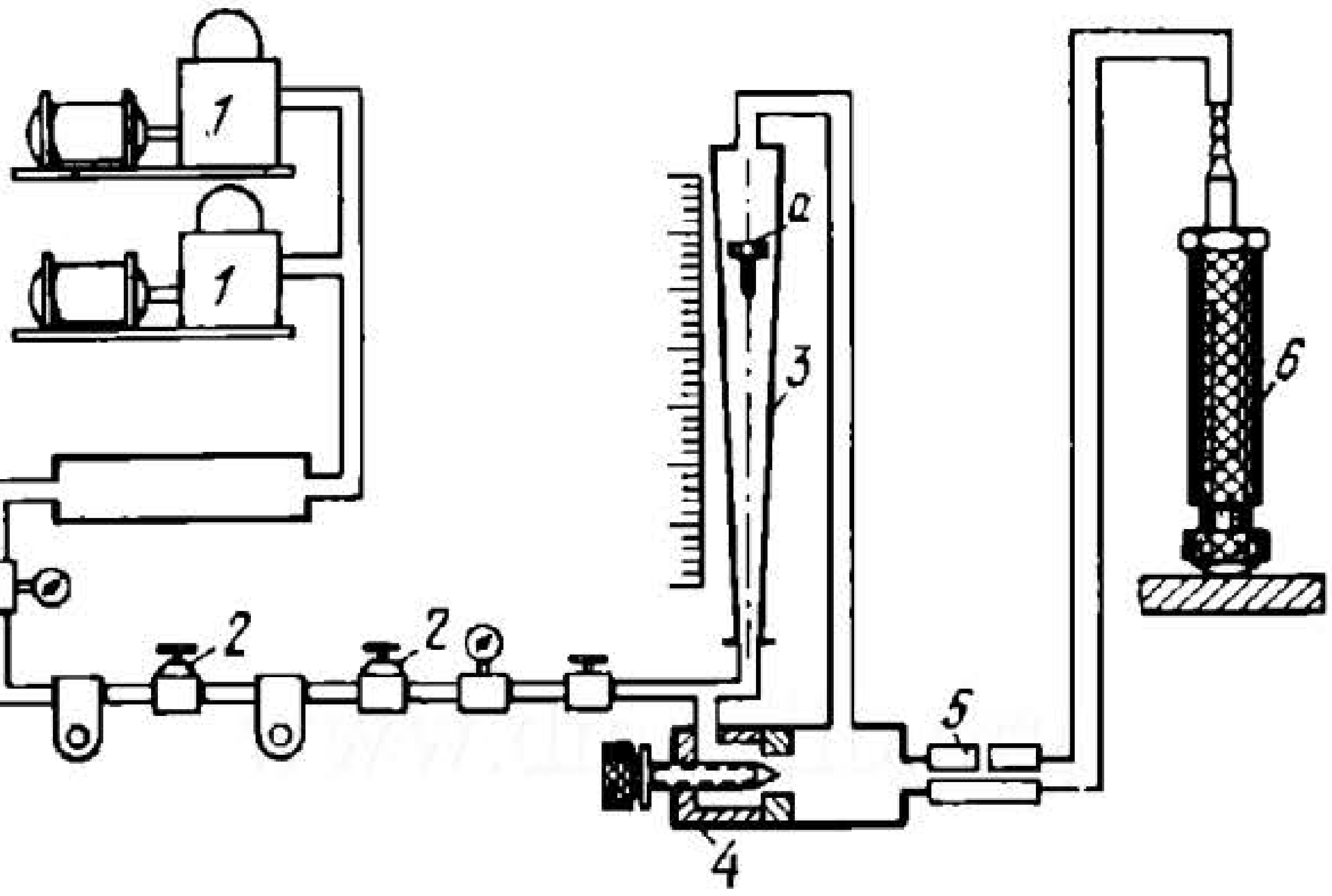
Air is pumped by rubber bulb *1* through water-type air-pressure stabilizer *2*, maintaining a constant pressure of compressed air, to orifice *3* through which it enters chamber *4*. Secured on rubber membrane *5* in the chamber is steel nozzle *6* with a bevelled lower edge and carefully lapped end face. Spring *7* holds nozzle *6* against the surface of the glass being checked. A weight is placed on the top of head *8* to be sure the face of the nozzle tightly contacts the glass. The pressure in the head chamber is an indication of the size and form of surface irregularities and is read off on manometer *9*, connected to the chamber. The manometer scale is graduated according to glass surface finish standards.

3713	WATER-COLUMN BACK-PRESSURE PNEUMATIC INSTRUMENT MECHANISM FOR SURFACE ROUGHNESS MEASUREMENT	SHP · M



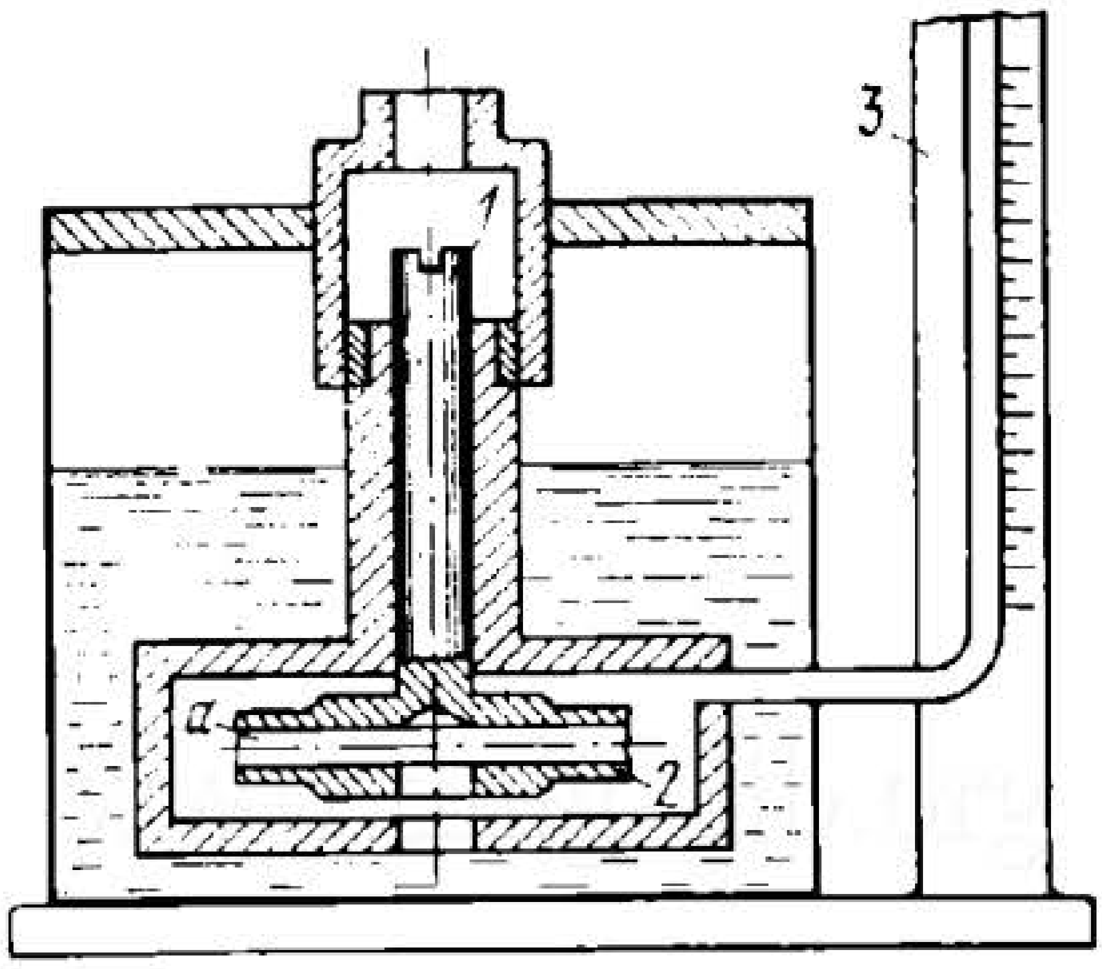
Compressor *1* delivers compressed air through water-type air-pressure stabilizer *2* and restrictor *a* into measuring chamber *3* which is connected to measuring head *4*. This head has measuring nozzle *5* on whose carefully lapped end face work *6* rests with its surface whose roughness is to be checked. The work is held against the nozzle by the spindle of vertical comparator *7*. The spindle has a spherical tip. The measuring head and the comparator spindle are strictly coaxial and are mounted on a common stand. The pressure in chamber *3*, measured by water-column manometer *8*, is an indication of the size of the surface irregularities. The manometer scale is graduated according to standard specimens.

3714	PNEUMATIC FLOW-GAUGE INSTRUMENT MECHANISM FOR CHECKING SURFACE ROUGHNESS	SHP M



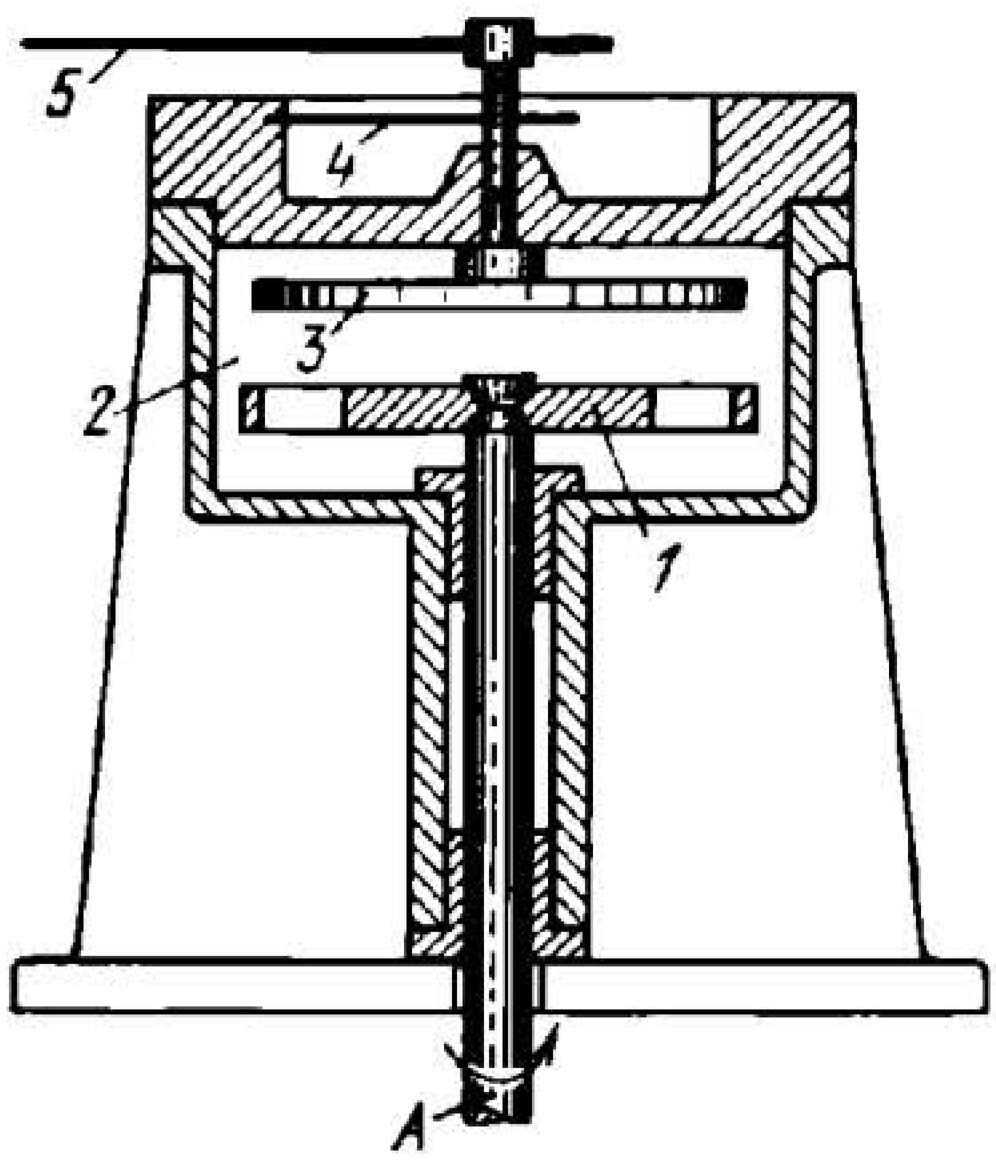
Compressed air, delivered by compressors 1, passes through air-pressure stabilizers 2 after which the stream of air is divided. A part passes through flow gauge 3 and the rest through conical valve 4. Then the air enters chamber 5 which has supplementary nozzles. The provision of these nozzles increases air flow through the glass tube of the flow gauge. From chamber 5 air flows to measuring head 6 whose stylus contacts the surface being checked. The surface irregularities vary the flow of air passing through the flow gauge and supporting the float indicator in suspension. The flow gauge scale is graduated according to surface finish standards.

3715	KARNAUKHOV HYDRAULIC TACHOMETER MECHANISM	SHP M



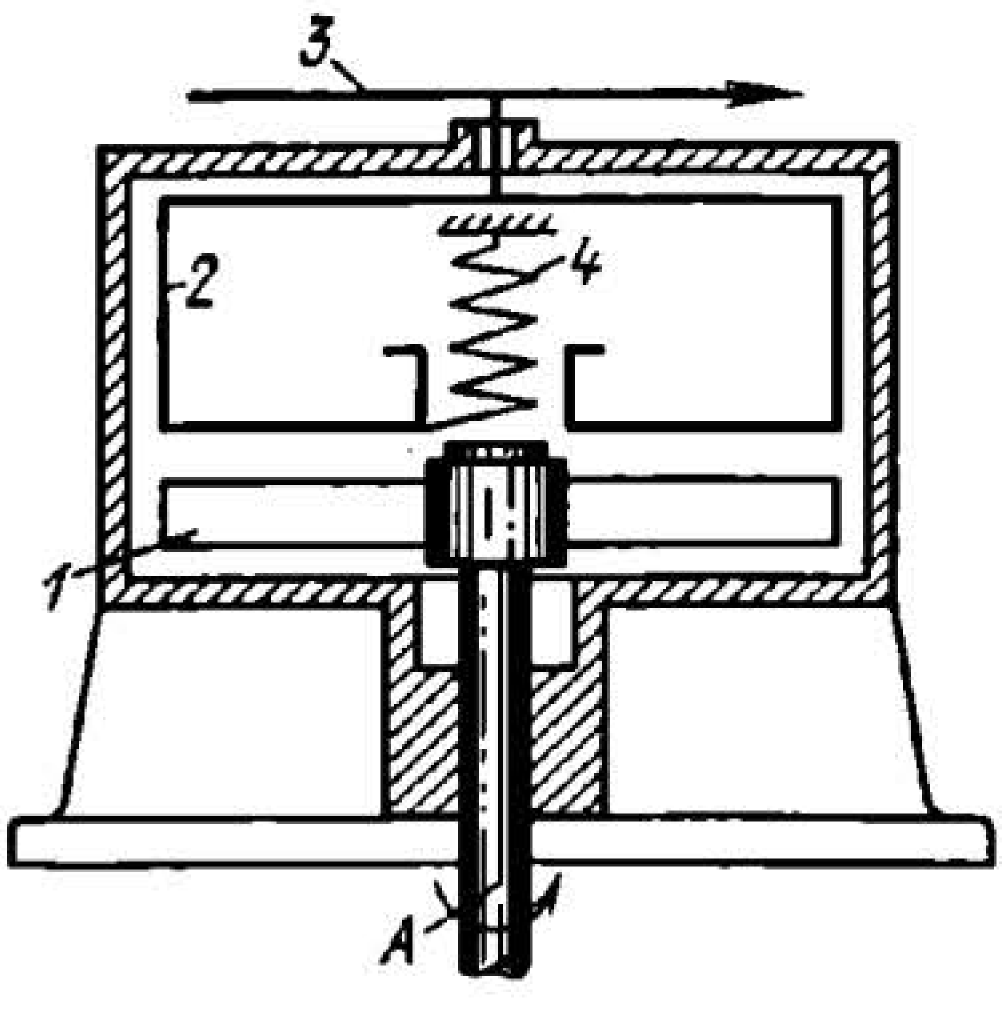
The tachometer is a centrifugal pump for which the magnitude of the delivery head, measured by the height of the column of liquid in a glass tube, is directly proportional to the speed of spindle *1*. Mounted on this spindle, which is driven by the shaft whose speed is to be measured, is rotor *2* with radial holes *a*. As the rotor rotates, the liquid is thrown outward from the centre to the periphery and its pressure, measured by manometer *3*, indicates the speed (in rpm) of the shaft being tested.

3716	HYDRAULIC TACHOMETER MECHANISM	SHP M



Shaft A of the tachometer is driven by the shaft whose speed is to be measured. Mounted on shaft A is disk *1* with holes. Disk *1* is located in a water-tight vessel *2* filled with mercury. As disk *1* rotates, the mercury begins to rotate as well and, owing to friction, tends to rotate light disk *3* which is prevented from rotating by hair spring *4*. The angle through which disk *3* turns, and it is rigidly linked to hand *5*, depends upon the angular velocity of the shaft being tested.

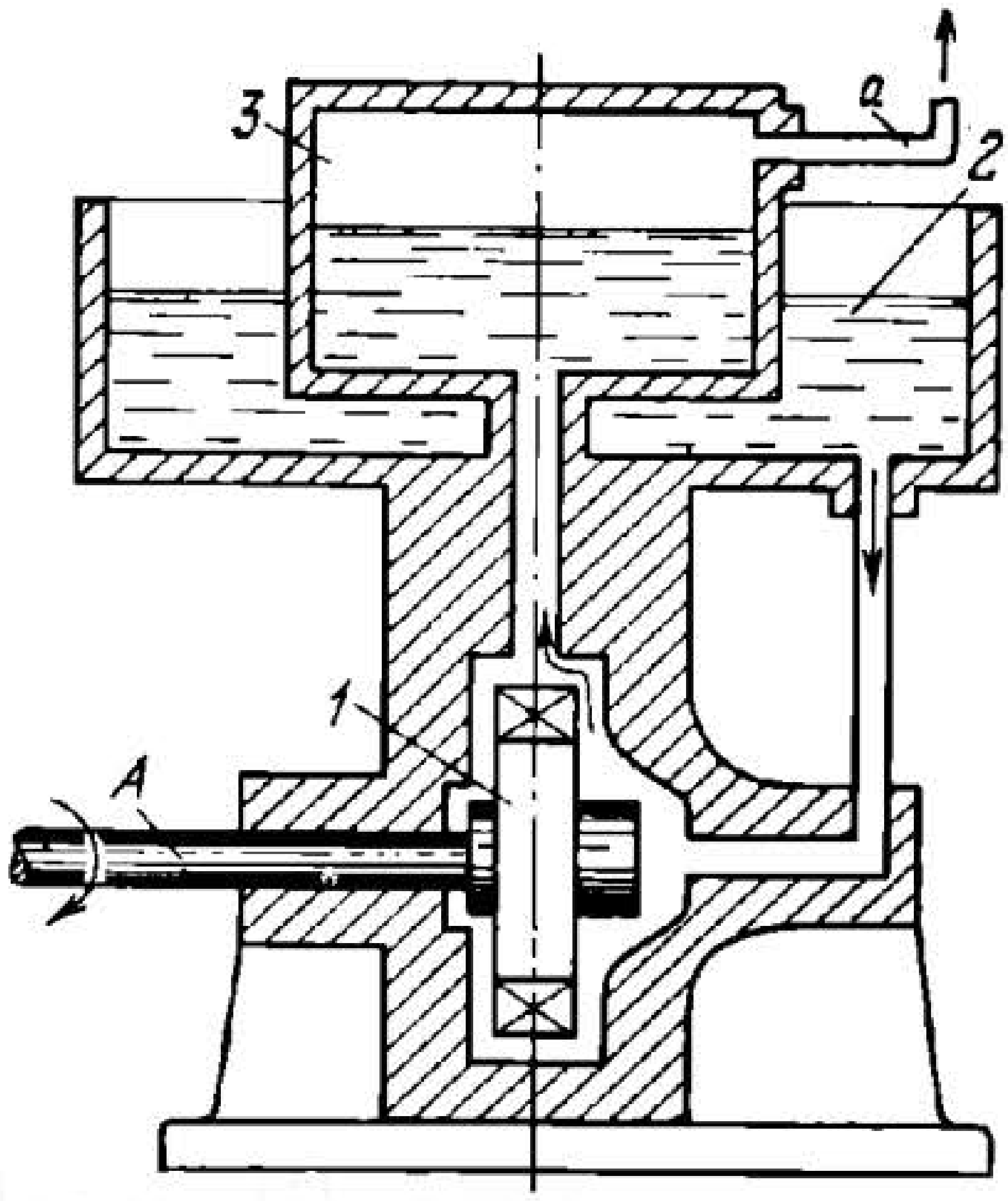
3717	PNEUMATIC TACHOMETER MECHANISM	SHP M



Shaft A of the tachometer is driven by the shaft whose speed is to be measured. Mounted on shaft A is an impeller with radial vanes *1*. When shaft A rotates, the impeller sets up a whirling air stream which, owing to friction, tends to rotate light metal cylinder *2*. Secured to the cylinder is hand *3* which stops in a position indicating the angular velocity of rotation of shaft A. Spring *4* prevents rotation of cylinder *2* and returns hand *3* to the zero position when shaft A stops.

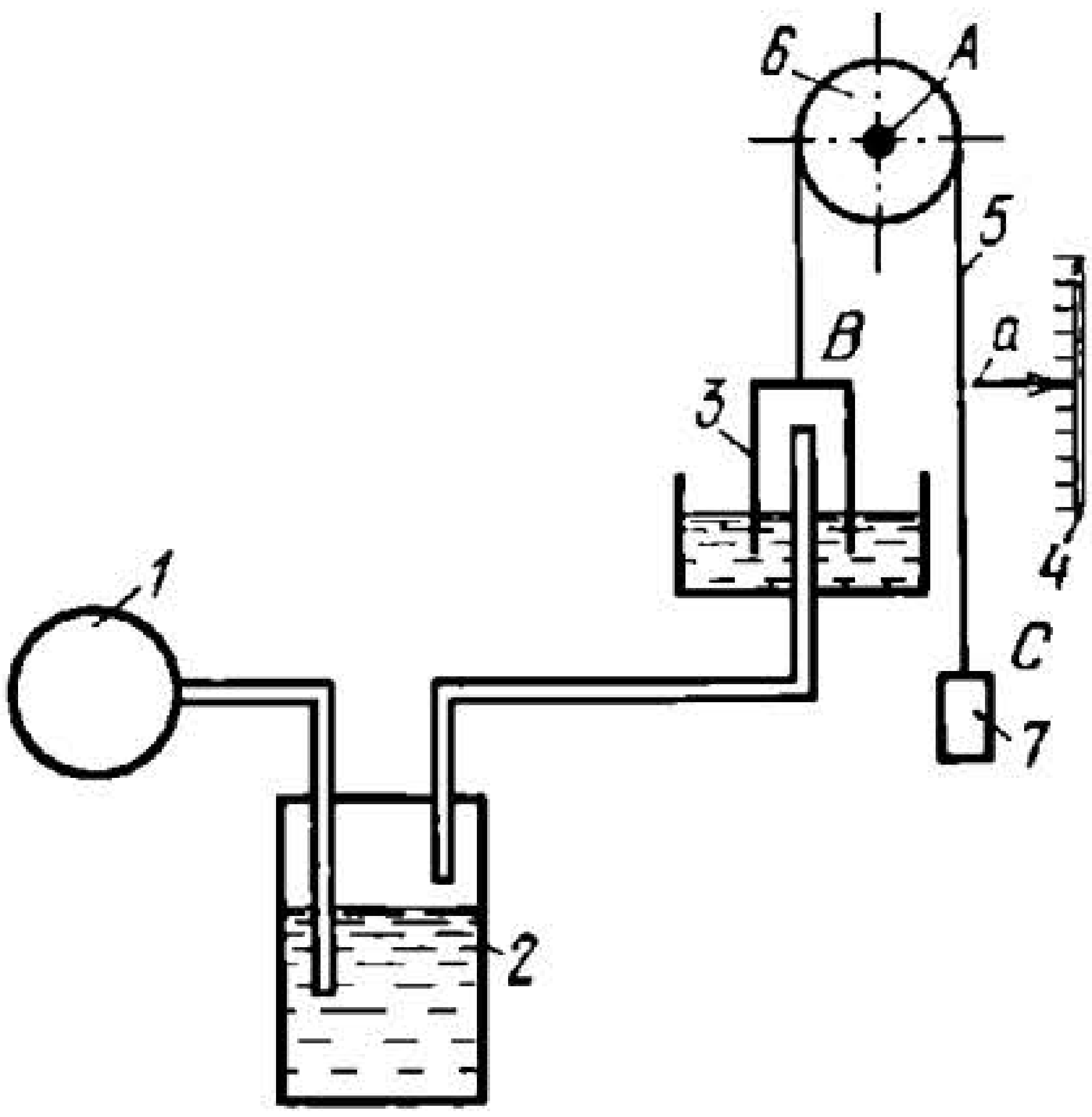
3718	REMOTE-READING HYDRAULIC TACHOMETER MECHANISM	SHP M

Mounted on shaft *A* of the tachometer, driven by the shaft whose speed is to be measured, is impeller *1* with radial vanes. Liquid is drawn from tank *2* and is pumped by the impeller into tank *3* whose free space is filled with air. This air is compressed and flows through tube *a* to a pressure gauge whose hand indicates the angular velocity of the shaft being tested.

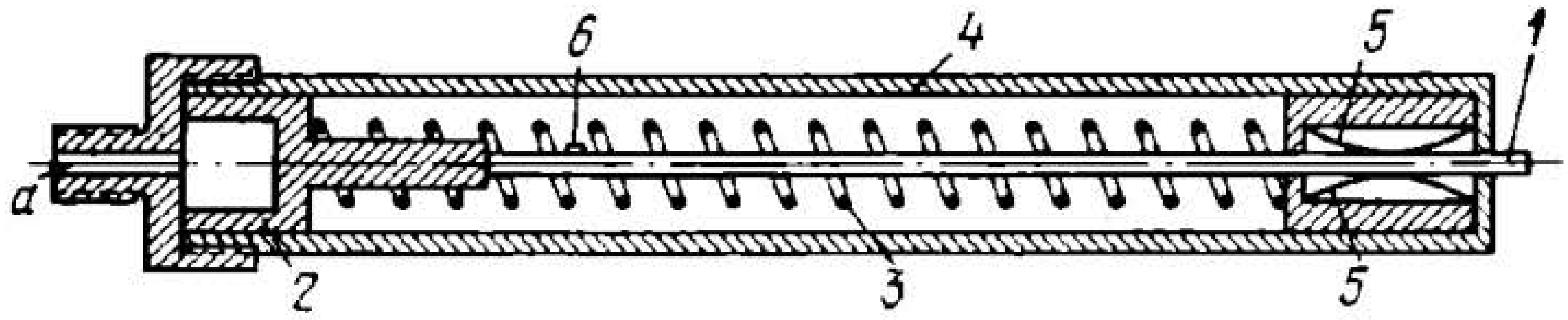


3719	AUTOMATIC GAS ANALYZER MECHANISM	SHP M

A definite volume of the gas being analysed is passed from initial measurement vessel *1* through absorbing vessel *2*, filled with a compound that absorbs the gas being analysed. The unabsorbed remainder of the gas passes into bell-shaped vessel *3*, displacing it. Flexible cord *5*, running over round pulley *6* which turns about fixed axis *A*, is linked to vessel *3* at *B* and to counterbalancing weight *7* at *C*. On scale *4*, hand *a*, rigidly secured to flexible cord *5*, indicates the reduction in volume corresponding to the absorbed volume of gas.

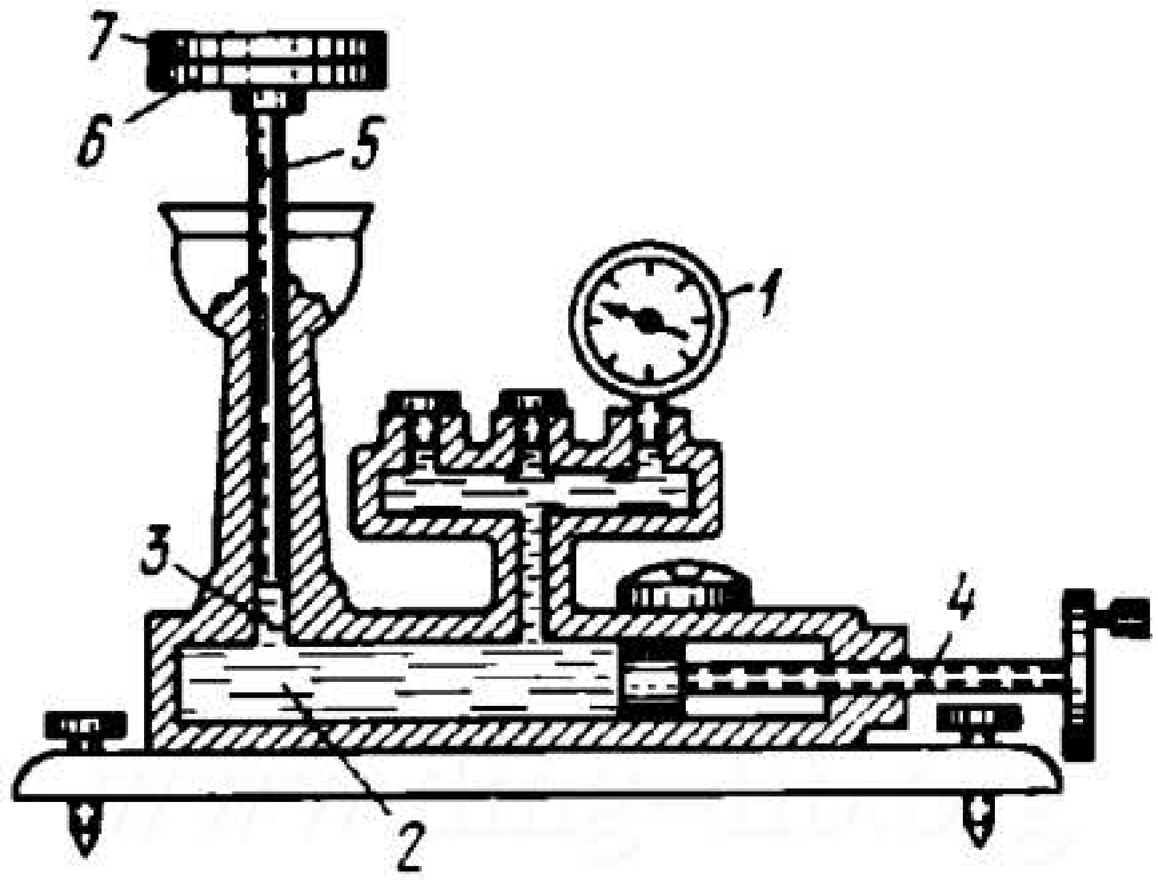


3720	PISTON-TYPE PNEUMATIC TIRE GAUGE MECHANISM	SHP M



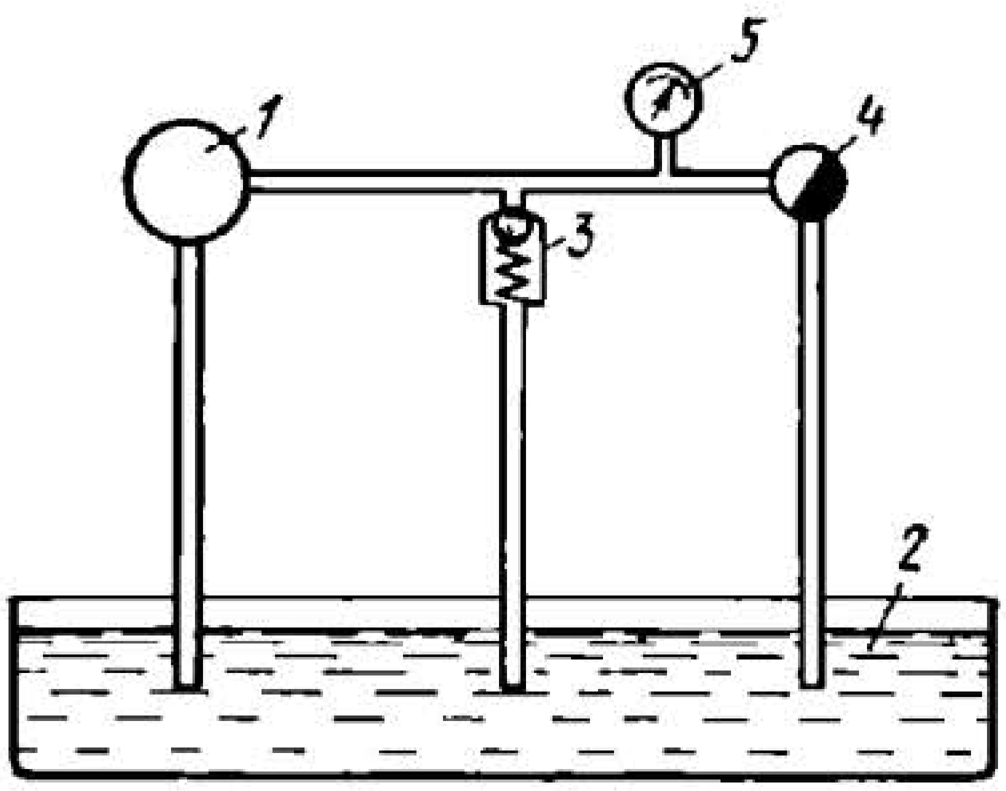
In measurement, hole *a* of the gauge is connected to the inner tube in which the pressure is to be measured. At this, stem *1* contacts piston *2*. The pressure in the tube pushes piston *2* to the right, overcoming the resistance of spring *3* and displacing stem *1*. When the gauge is disconnected from the inner tube, the pressure in piston *2* drops and spring *3* returns the piston to its initial position. Stem *1*, held by flat springs *5*, remains in the position it was pushed by piston *2*. The measured pressure is indicated on a scale which is inscribed on stem *1* (by the amount of the stem sticking out of cylindrical body *4*). Before the next measurement the stem is pushed back into the body. Pin *6* prevents stem *1* from being pulled entirely out of body *4*.

3721	PRESSURE GAUGE TESTING MECHANISM	SHP M



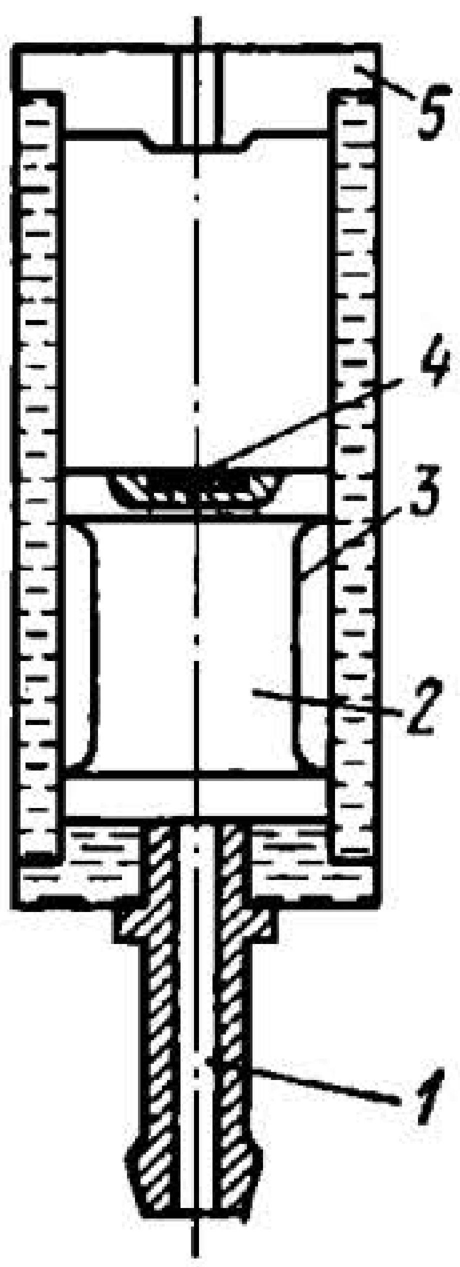
Pressure gauge *1* to be tested is screwed into one of the pipe connections of a manifold which communicates with horizontal tank *2* and vertical cylinder *3* filled with a liquid. The volume of tank *2* can be varied by means of a piston adjusted horizontally by screw *4*. Inserted into the vertical cylinder is plunger *5* with plate *6* which by their weight develop a pressure in the tank and manifold. The weights of the plunger and plate, as well as that of weights *7*, and the cross-sectional area of the vertical cylinder are strictly specified. Loading the plate consecutively with weights *7*, the readings of the pressure gauge are checked.

3722 RELIEF VALVE TESTING OUTFIT MECHANISM — SHP M



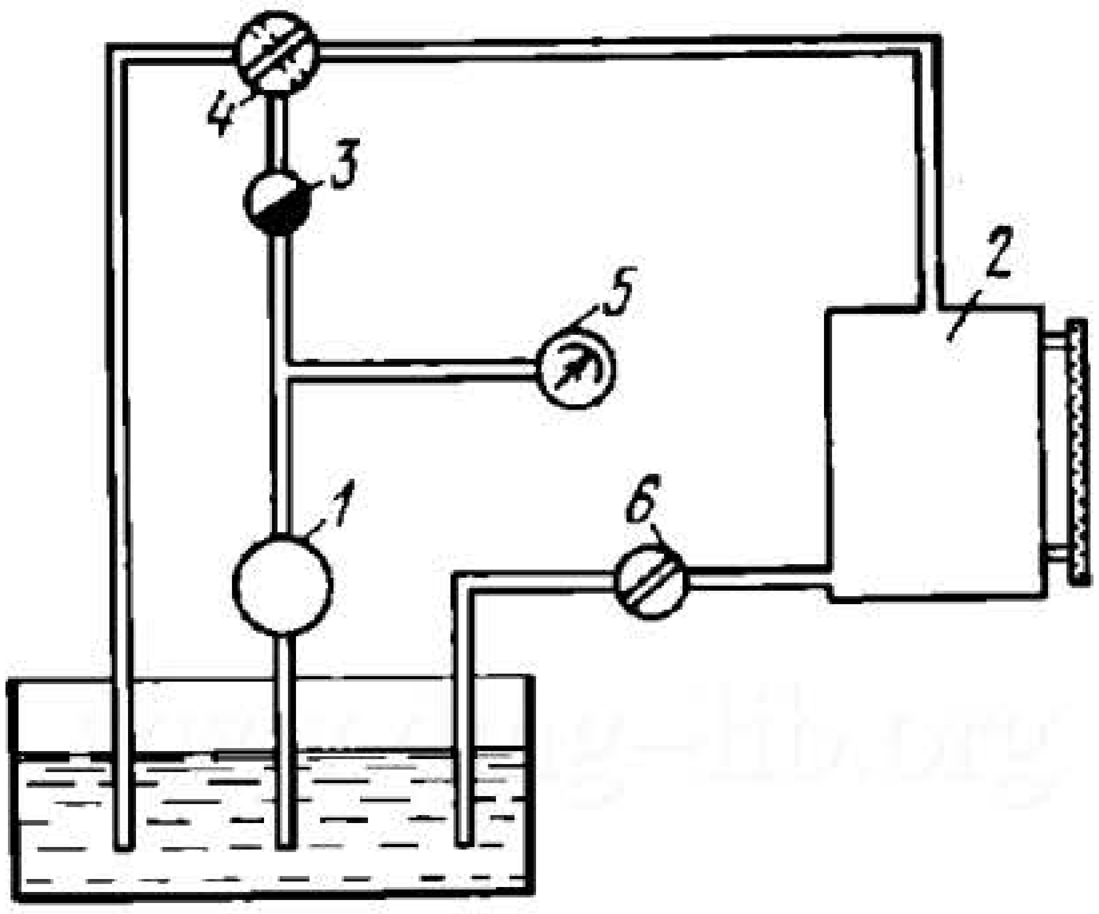
The purpose of the test is to plot a characteristic curve of the valve. This curve shows the dependence of the volume of liquid passed by the valve per minute on the pressure in the delivery pipeline. In the test, liquid drawn up by pump *1* from tank *2* passes through relief valve *3* and flow-control valve *4*, connected in parallel. When flow-control valve *4* is closed, all the liquid is discharged to the tank through relief valve *3*. If valve *4* is partly opened, part of the liquid passes through it and the rest through relief valve *3*. The pressure of the liquid is measured by pressure gauge *5*.

3723 PNEUMATIC PRESSURE INDICATOR MECHANISM — SHP M



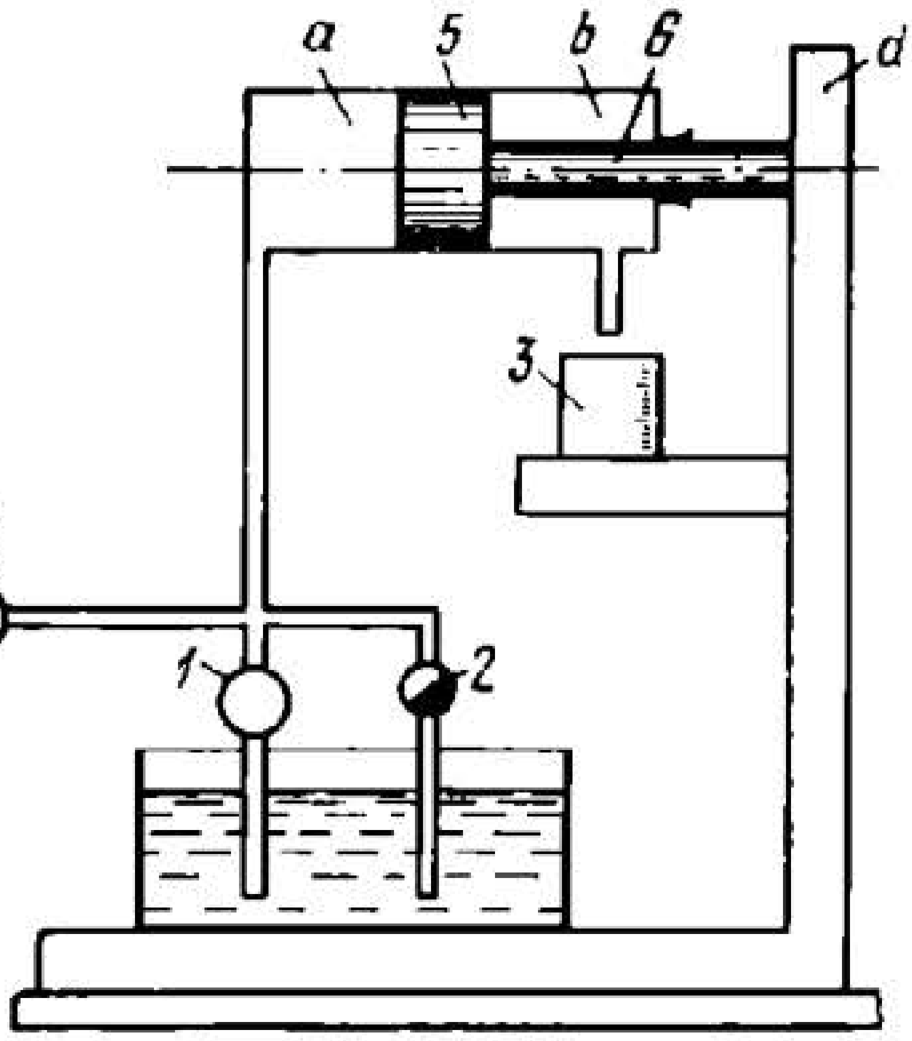
When a pressure is developed, air enters through hole *1* and raises piston *2* in a transparent cylinder of plexiglas. At the end of the piston stroke, rubber insert *4* closes the hole in cover *5* leading to the atmosphere. The side surfaces of the piston are painted red. By watching the piston, the operator can tell when he has air under pressure. When hole *1* is connected to the atmosphere, piston *2* drops to its lower position by gravity. This indicator is employed on the pneumatic control panels of complex control systems and has the same function as a signal lamp in an automatic electrical system.

3724	MECHANISM FOR MEASURING THE VOLUMETRIC EFFICIENCY OF PUMPS	SHP M



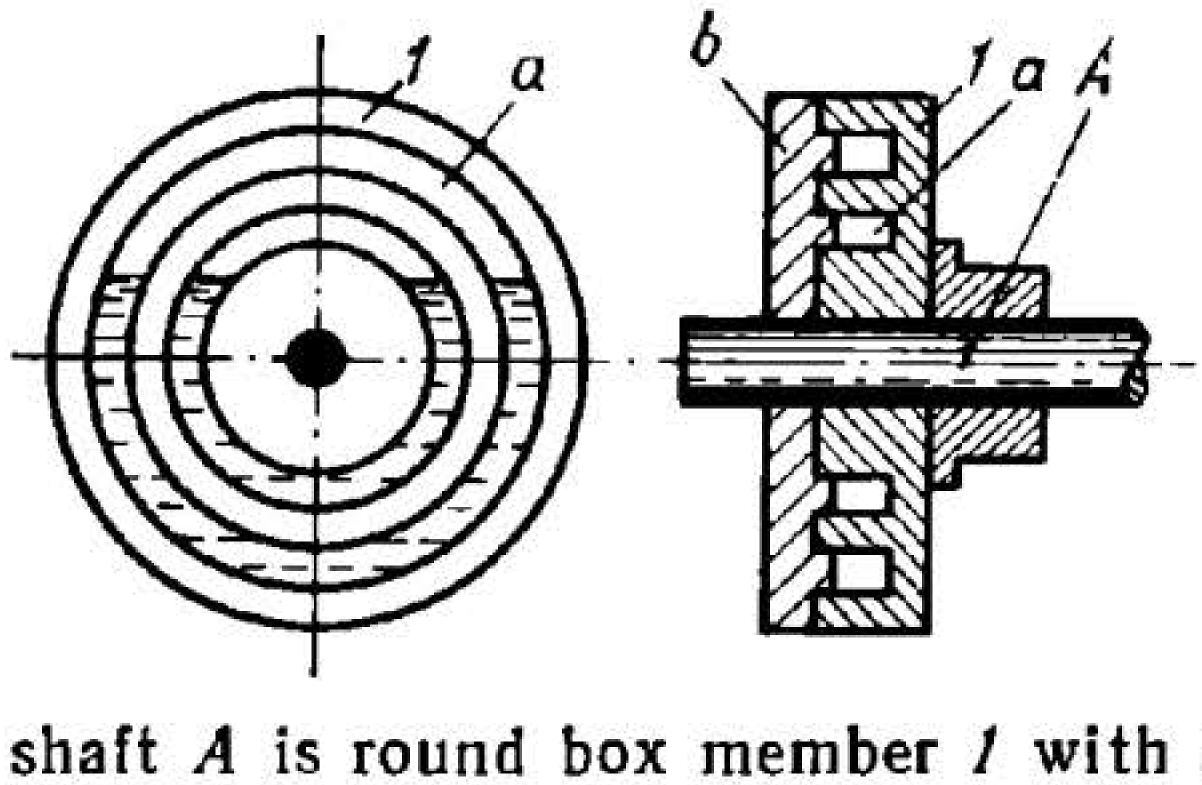
Pump 1 delivers liquid through throttle valve 3 and three-way valve 4. The required pressure, developed by throttle valve 3, is controlled by pressure gauge 5. Liquid flows from the three-way valve to gauging tank 2 and the amount of liquid is measured after a definite time interval. Such measurement is also made without pressure which is relieved by opening throttle valve 3. With valve 4 in the position shown by the dash lines, the liquid drains back to the tank. Valve 6 serves to drain the liquid from the gauging tank back to the tank.

3725	CYLINDER LEAKAGE TESTING MECHANISM	SHP M



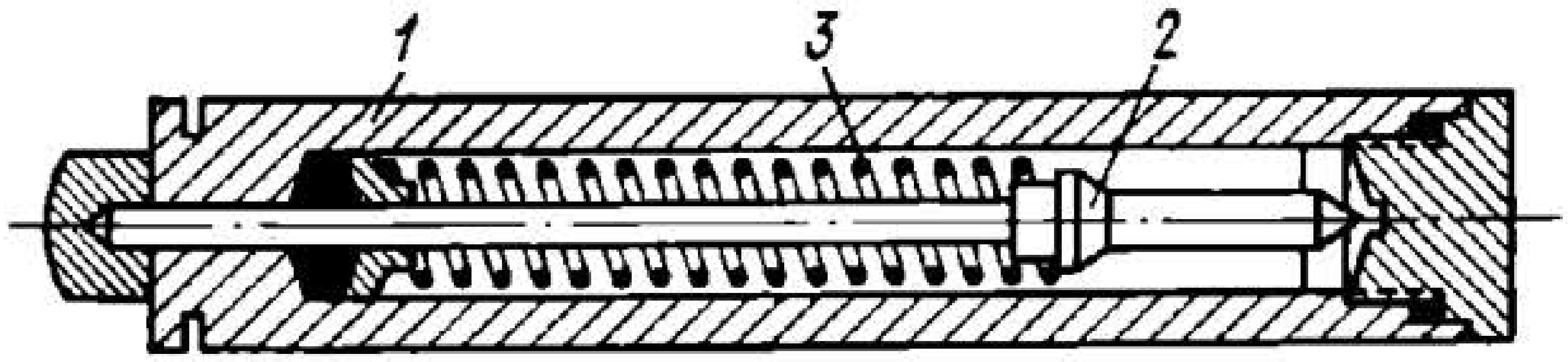
To measure the amount of leakage, rod *6* of piston *5* is run up against rigid stop *d*. By means of pump *1* and throttle valve *2*, the working pressure, controlled by pressure gauge *4*, is set up in the left end of the cylinder. Leakage from end *a* to end *b* is measured by gauging vessel *3*.

3726	SHAFT SPEED EQUALIZING MECHANISM	SHP M



Mounted on shaft *A* is round box member *1* with a number of concentric grooves *a*. The grooves are partly filled with a liquid and the box is closed by cover *b*. As the shaft begins to rotate the liquid is at rest with respect to the walls of the groove. Owing to friction, the liquid begins to rotate and finally reaches a speed equal to that of box *1*. Owing to its inertia and viscosity, the liquid tends to maintain a constant shaft speed, notwithstanding variations in speed in the drive.

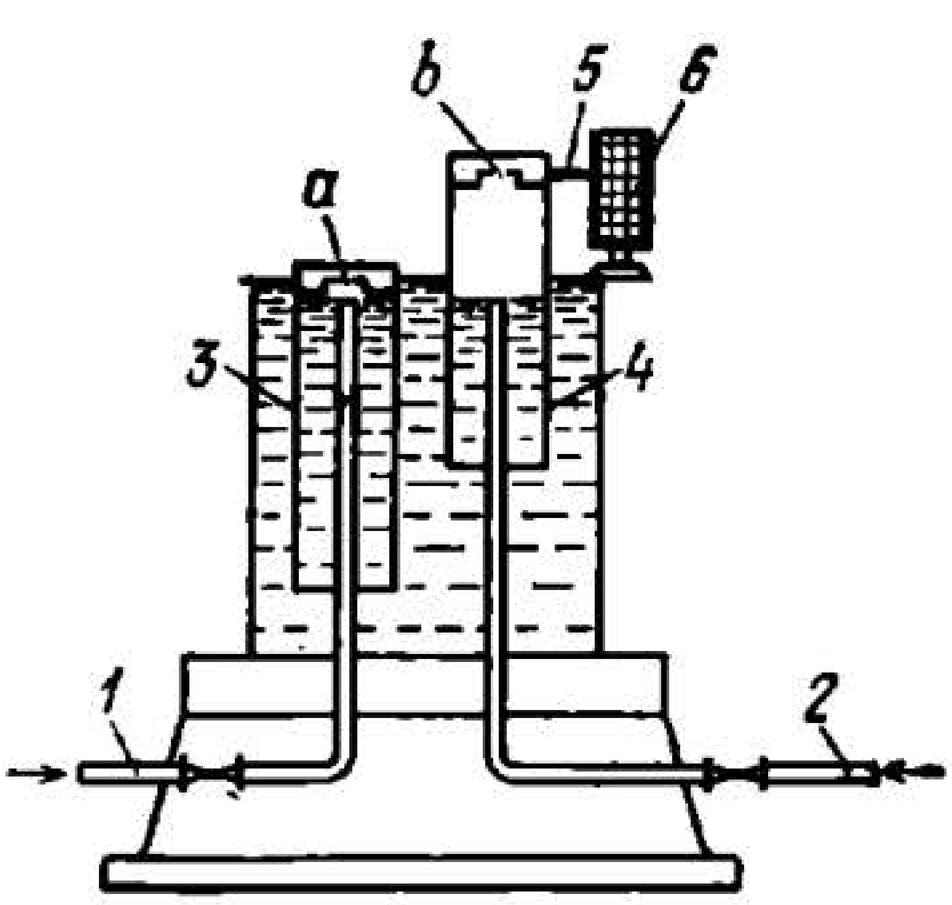
3727	THERMOSTAT MECHANISM	SHP M



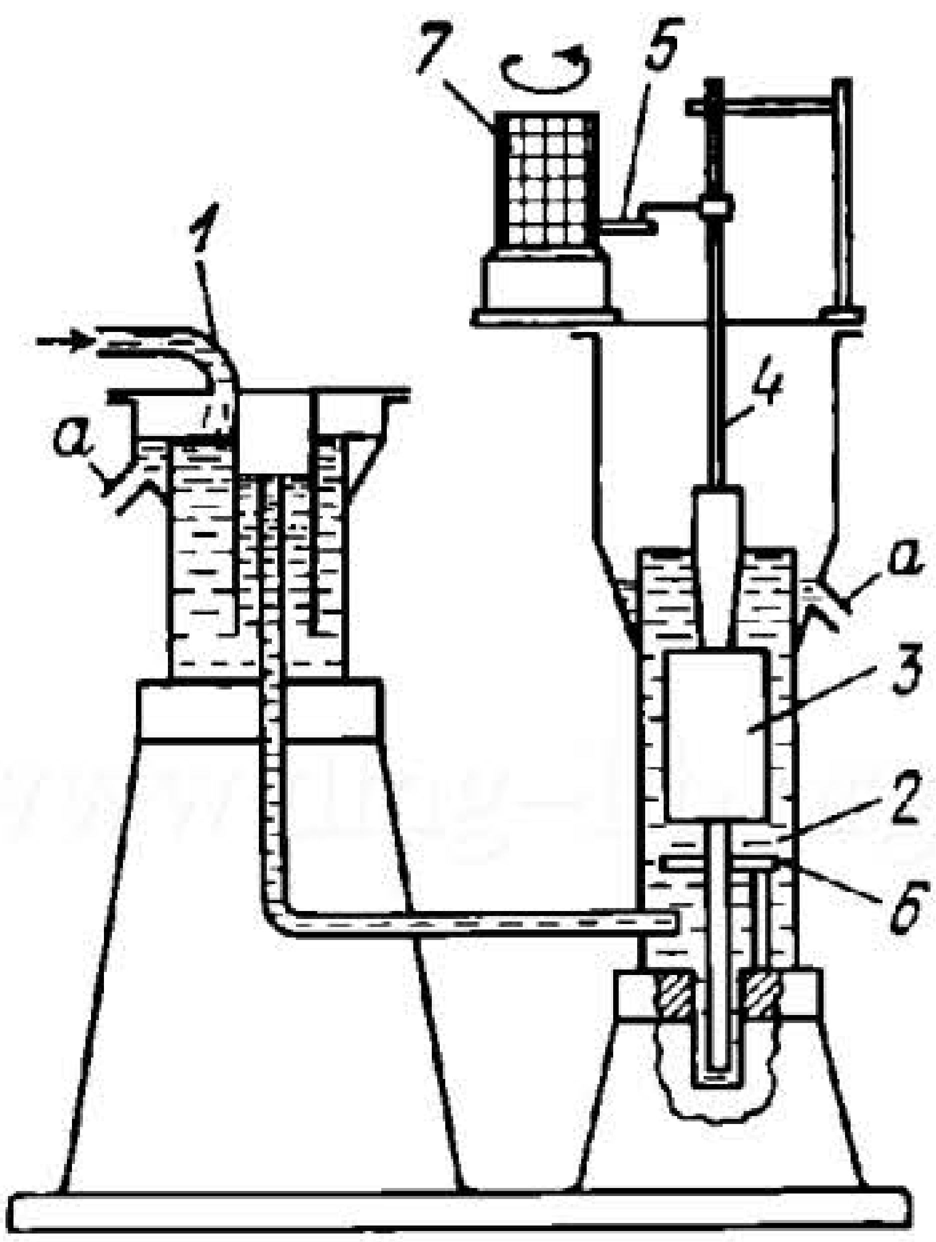
Upon a rise in temperature of the surrounding medium (ambient temperature), the wax-like substance filling the hole in body *1* expands and pushes out stem *2*. This starts up a refrigerating system. As the temperature drops, the volume of the filling substance is reduced and the stem is returned to its initial position by spring *3*.

3728	GAS DENSITY MEASURING MECHANISM	SHP M

Gas enters vessel *3* through pipe *1* and air enters vessel *4* through pipe *2*. After filling the vessels, both gases flow out through narrow holes *a* and *b* at the same pressure. The more vessel *4* descends to the moment when vessel *3* is empty, the greater the density of the gas being investigated. The amount of descent of vessel *4* is registered by recording device *5* on graph paper strip *6* and serves as a measure of density of the investigated gas.

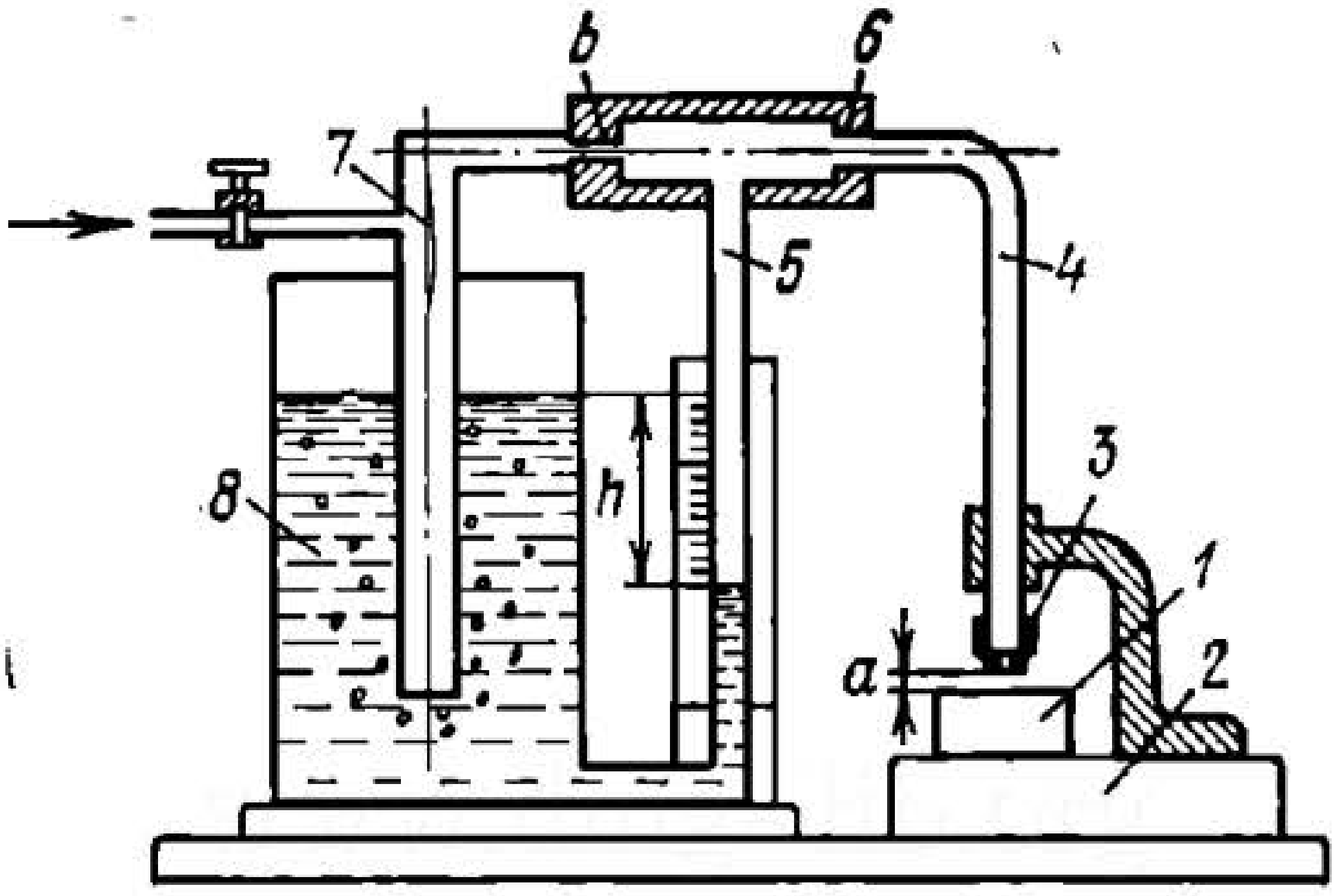


3729 | **SOLUTION DENSITY RECORDER MECHANISM** | SHP M



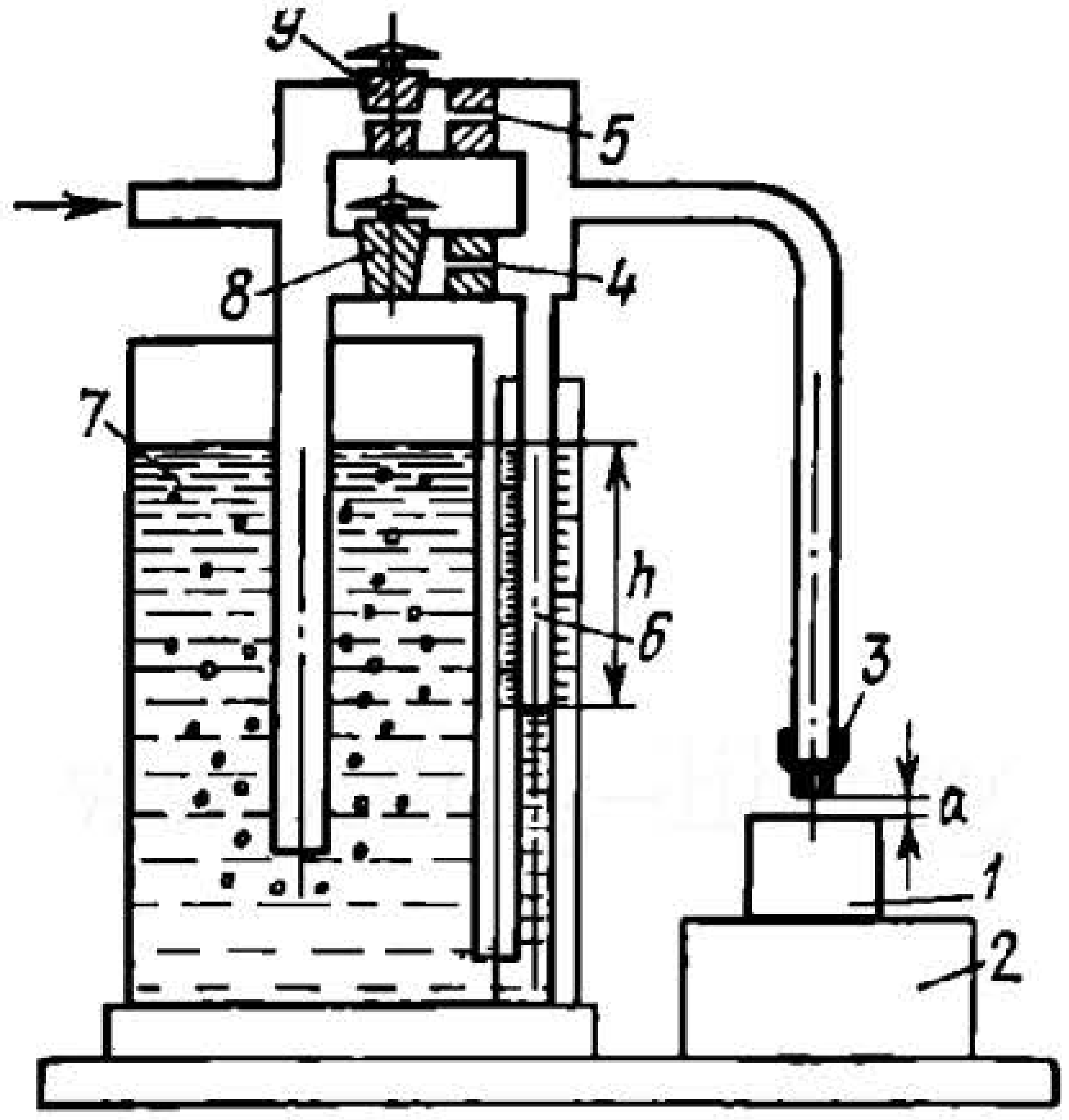
Upon continuous delivery of the liquid being investigated along pipe *1* into vessel *2*, recording pen *5*, linked by rod *4* to float *3*, draws a curve showing the variation in density of the investigated liquid. The curve is recorded on a graph paper strip attached to drum *7* which rotates about its axis. Baffle plate *6* protects float *3* against the action of nonuniform flow of the liquid. Overflow *a* maintains a constant level of liquid in vessel *2*.

3730	WATER-COLUMN BACK-PRESSURE PNEUMATIC GAUGE MECHANISM	SHP M



Work 1 to be checked is placed on base 2, and above the work, with a certain clearance, measuring head 3 is rigidly mounted. This head is connected by tube 4 to measuring chamber 6 into which compressed air enters through small orifice (restrictor) b. Tube 7, immersed in water chamber 8, serves to maintain constant air pressure. Surplus air is evolved as bubbles. Manometer 5 is connected to measuring chamber 6 and to water chamber 8. The difference in height h between the levels in water chamber 8 and manometer 5 depends upon the clearance a between the metering orifice of measuring head 3 and work 1. The manometer tube is graduated in units of deviation of the size of the work from the specified value.

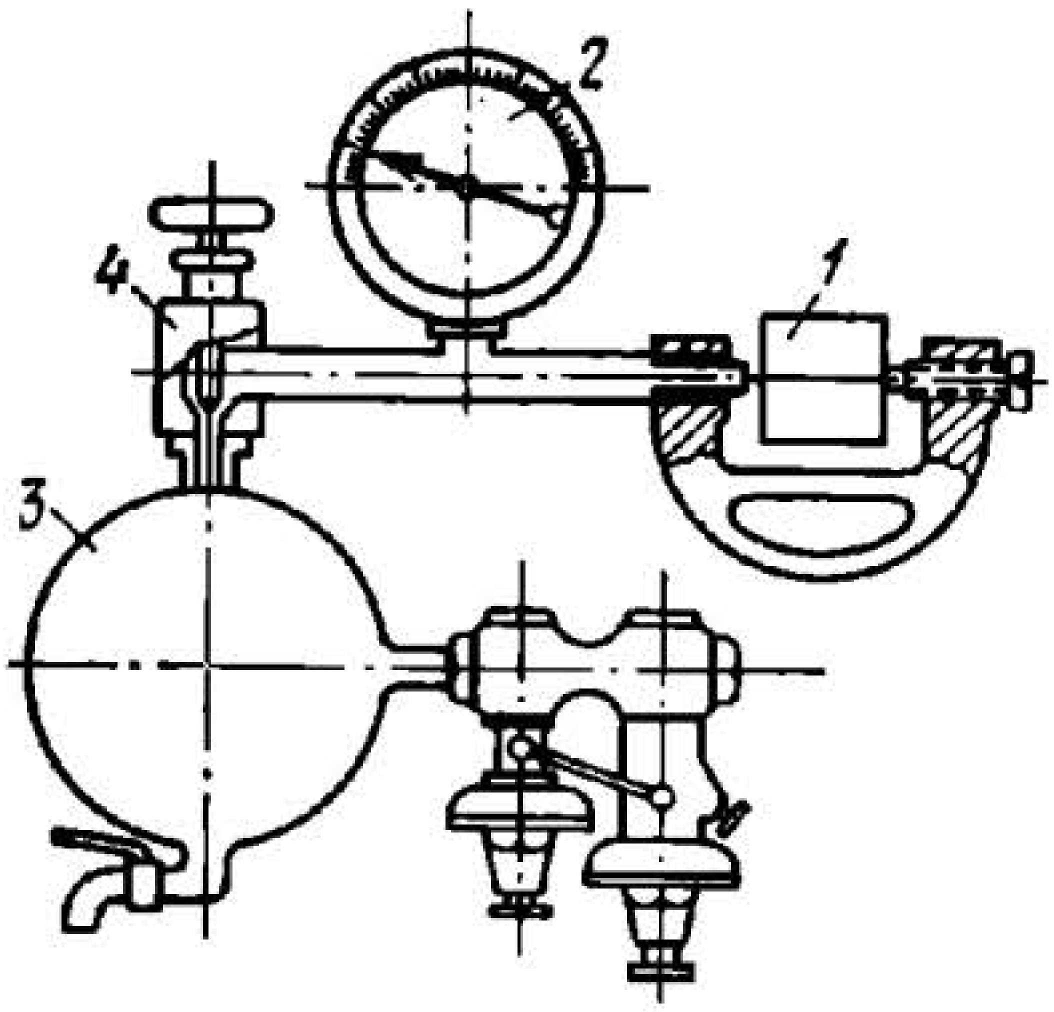
3731	WATER-COLUMN BACK-PRESSURE PNEUMATIC GAUGE MECHANISM WITH TWO MEASURING RANGES	SHP M



Work *1*, placed on base *2*, is measured by reading off the difference *h* in the levels of water chamber *7* and manometer *6*. This difference depends upon the clearance *a* between the metering orifice of measuring head *3* and the work. To obtain two ranges of measurement, the instrument has two measuring chambers with two restrictors, *4* and *5*. Either chamber can be put into operation by opening and closing the corresponding valves *8* and *9*.

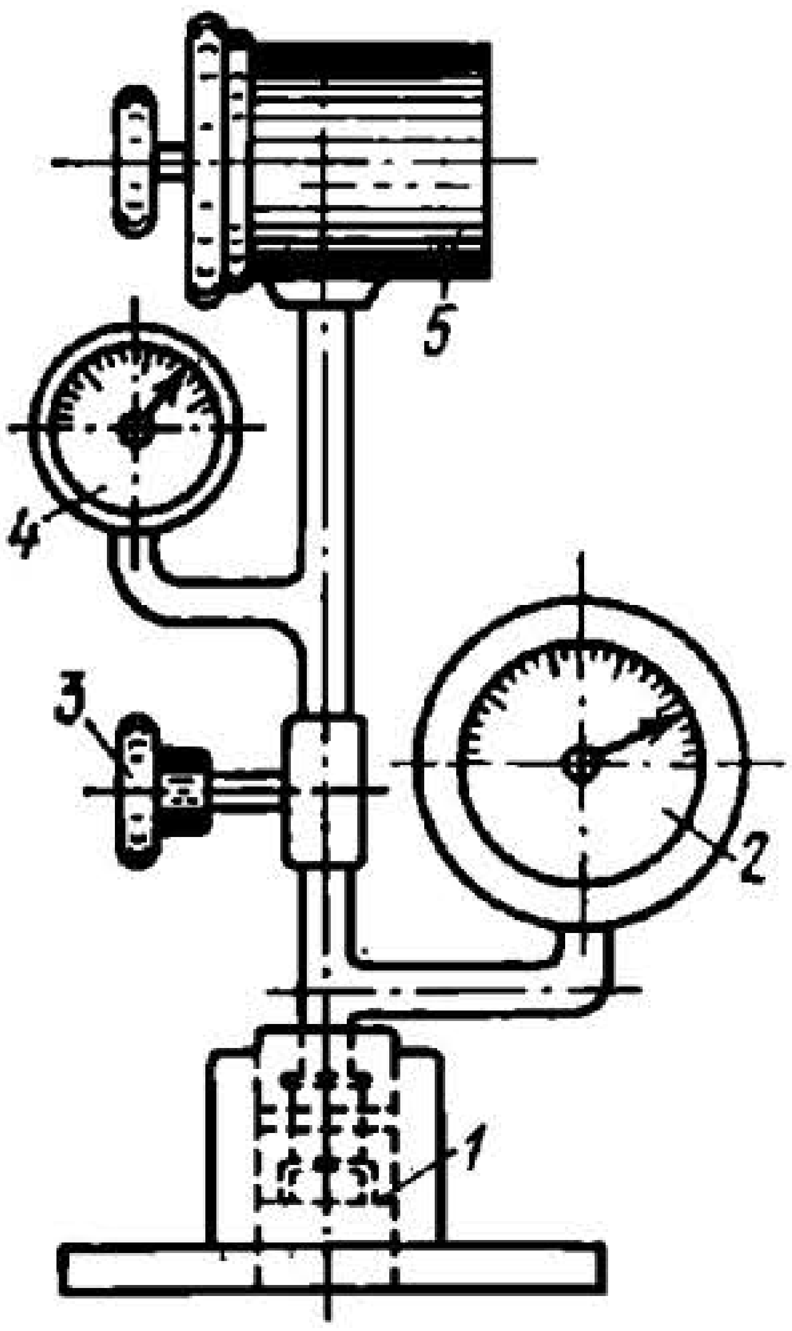
3732	BACK-PRESSURE PNEUMATIC GAUGE MECHANISM	SHP M

Work *1* is measured on the basis of the dependence between the pressure in the measuring chamber and the clearance between the metering orifice of the gauge and the work. Pressure gauge *2* indicates the air pressure in the measuring chamber. The working pressure in the instrument is equalized by means of receiver *3* which is connected to the pressure reducer (regulator). Adjustable flow-control valve *4* enables the range of measurement of the instrument to be varied.

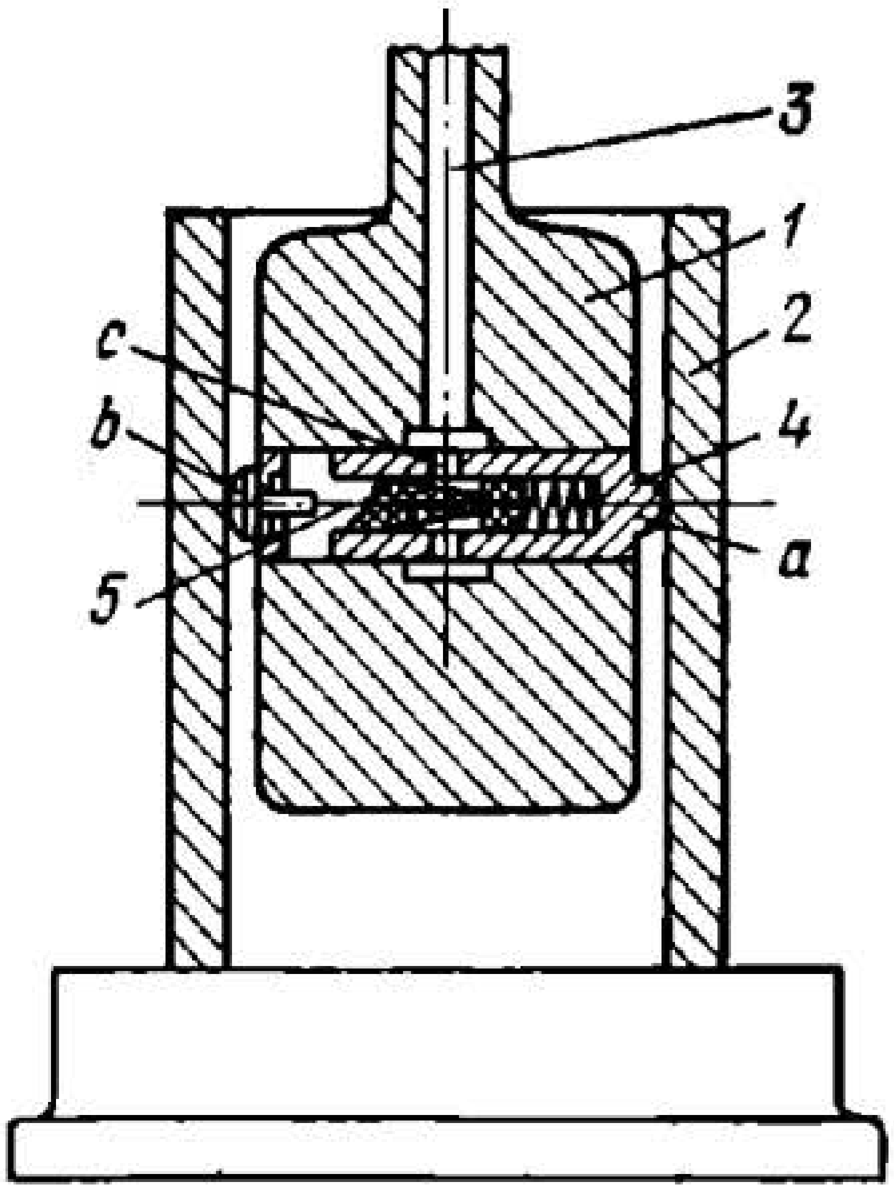


3733	BACK-PRESSURE PNEUMATIC GAUGE MECHANISM	SHP M

Compressed air is delivered to pressure reducer (regulator) *5* which maintains constant air pressure. Then the air passes through adjustable flow-control valve *3* and into measuring head *1*. Pressure gauge *2* indicates the pressure in the measuring chamber which depends upon the clearance between the gauge member and the work being checked. Pressure gauge *4* indicates the working pressure.

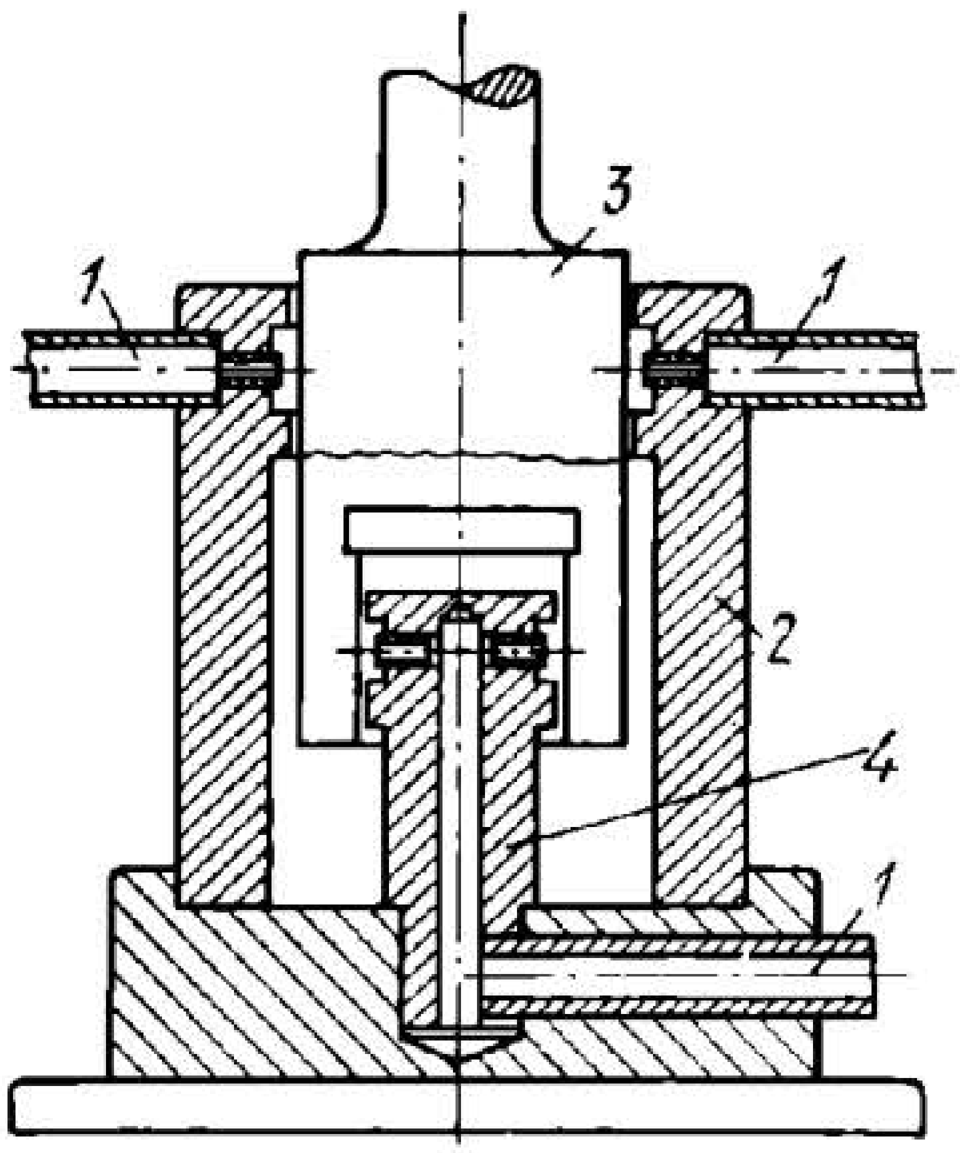


3734	BACK-PRESSURE PNEUMATIC INTERNAL GAUGE MECHANISM	SHP M



Measuring plug 1 is inserted into the bore of work 2. Axial channel 3 is connected to the measuring chamber from which compressed air is delivered to the plug and where its pressure is measured. The plug contains bushing 4 whose tip a contacts the bore surface of work 2. Sliding in the bushing is plunger 5 into which ball-head pin b is pressfitted. Pin b contacts the bore surface opposite tip a. Plunger 5 is tapered and partly closes air outlet orifice c. Depending upon the size of the bore diameter of the work, the plunger opens the air outlet orifice the corresponding amount. This is used to measure the bore diameter.

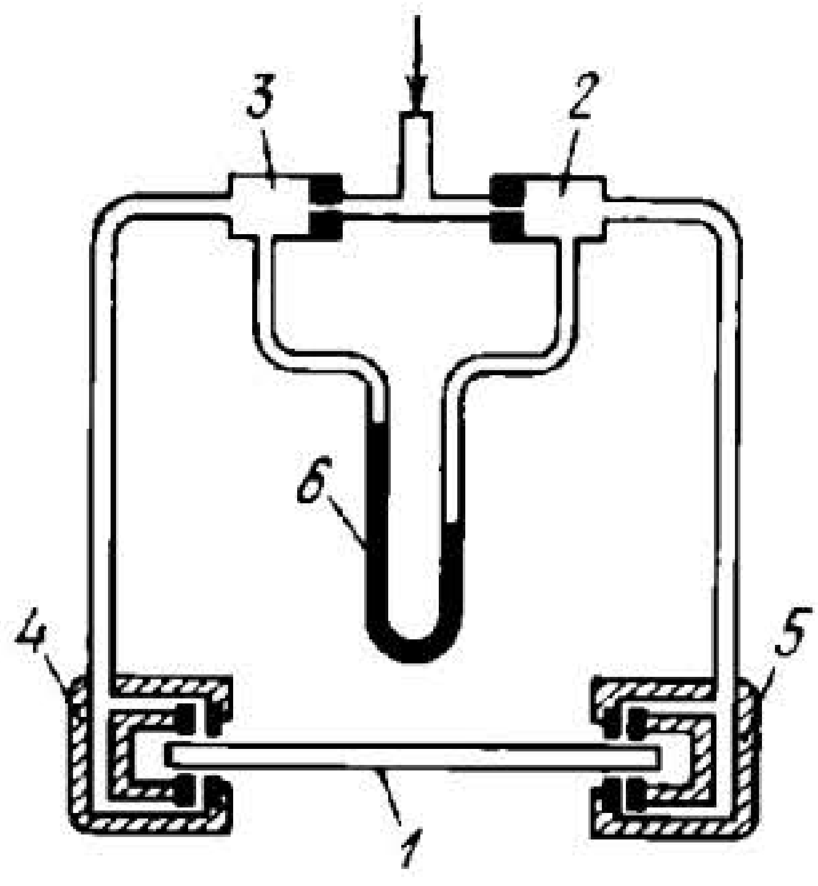
3735	BACK-PRESSURE PNEUMATIC GAUGE MECHANISM FOR SIMULTANEOUS EXTERNAL AND INTERNAL MEASUREMENTS	SHP M



Gauging nozzles 1 are connected to the measuring chamber from which compressed air is delivered to measuring head 2. The clearance between the gauging nozzles and work 3 depends upon the size of work 3. The variation in air flow depending on this clearance is used to check the size of the work. Simultaneously, the hole in work 3 is checked on the basis of the clearance between measuring plug 4 and the hole.

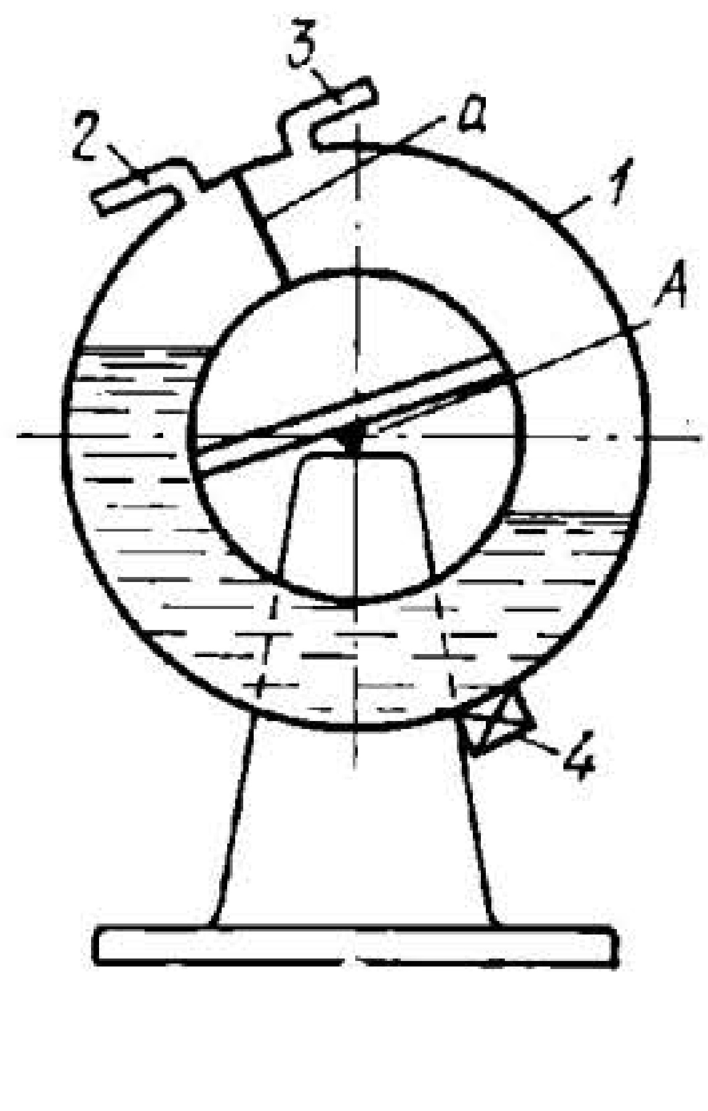
3736	BACK-PRESSURE PNEUMATIC GAUGE MECHANISM FOR CHECKING PARALLELISM	SHP M

Work 1 to be checked is placed with its ends in dual-jet snap gauges 4 and 5 which have metering orifices connected to measuring chambers 3 and 2. These chambers are connected to the branches of U-type manometer 6. If the surfaces of the work are parallel, the pressure in both measuring chambers will be the same and the liquid in the branches of the manometer will be at the same level. The lack of parallelism is indicated by the reading of the manometer.



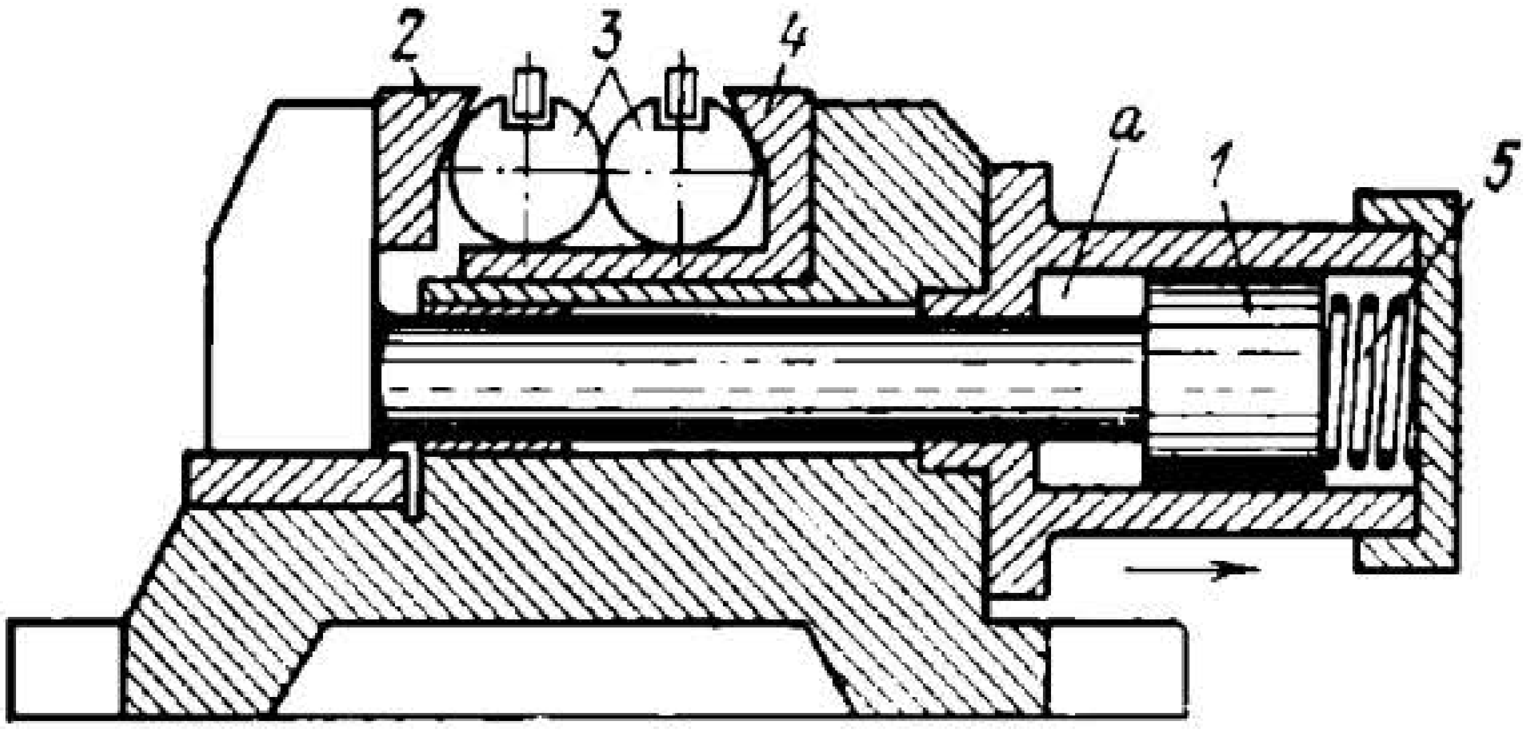
3737	HYDRAULIC TILTING-RING MANOMETER MECHANISM	SHP M

Hollow ring 1 of rectangular cross section can turn on a knife-edge bearing about its geometric axis A. Inside, ring 1 has partition a. Gas at the standard pressure and at the pressure to be measured is delivered to connections 2 and 3. Weight 4 is attached outside ring 1 to obtain the pressure to be measured inside. The inside space of the ring is partly filled with a liquid. If the pressures are not equal on the two sides of partition a, ring 1 turns through a certain angle because the liquid levels are not the same. The angle the ring turns is proportional to the pressure difference on the two sides of the partition and is indicated on a scale which is not shown.



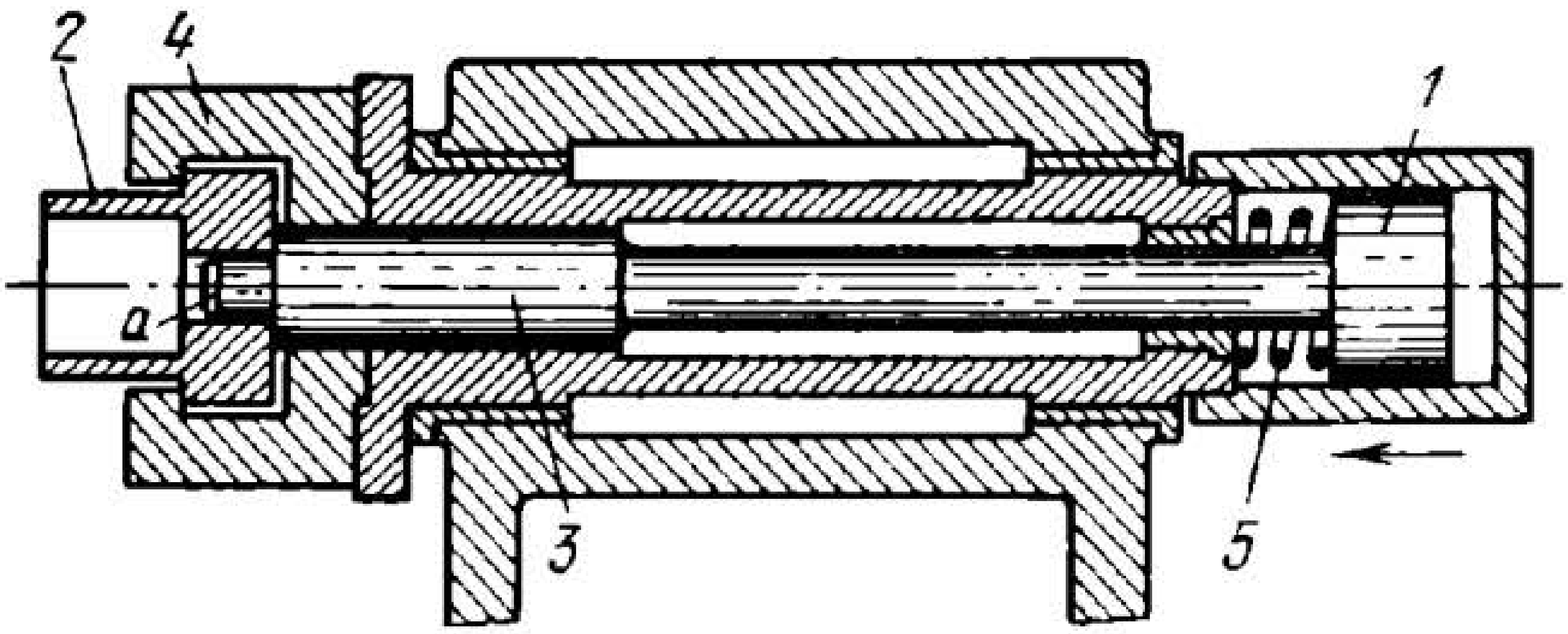
6. GRIPPING, CLAMPING AND EXPANDING MECHANISMS (3738 through 3748)

3738	HYDRAULIC VISE MECHANISM	SHP GC



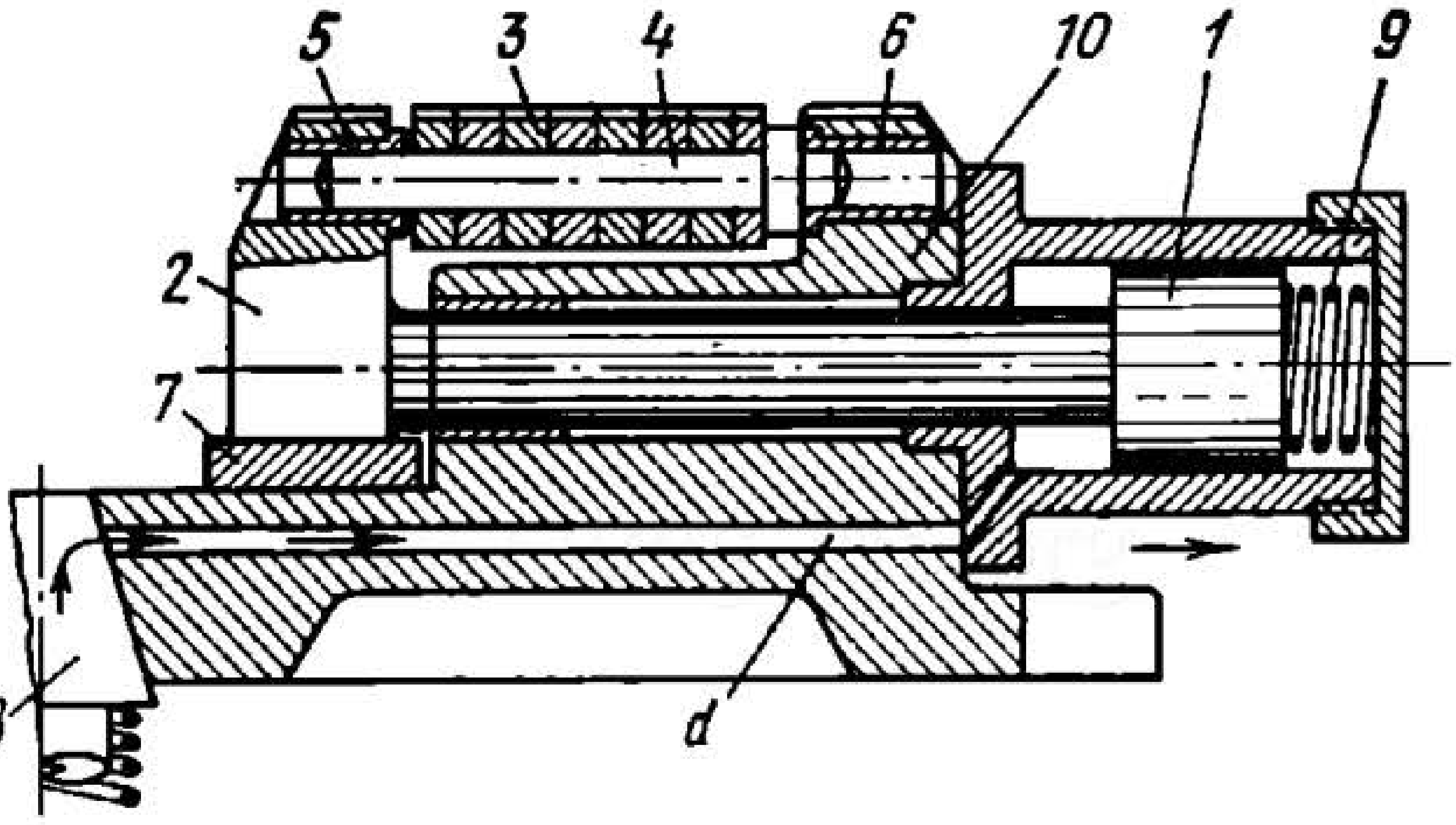
When piston *1* moves to the right by the action of fluid delivered to end *a* of the cylinder, movable bevelled jaw *2*, rigidly linked to the piston, clamps two round workpieces *3*. Stationary jaw *4* is also bevelled. As piston *1* is moved to the left by spring *5*, workpieces *3* are released.

3739	HYDRAULIC VISE MECHANISM	SHP GC



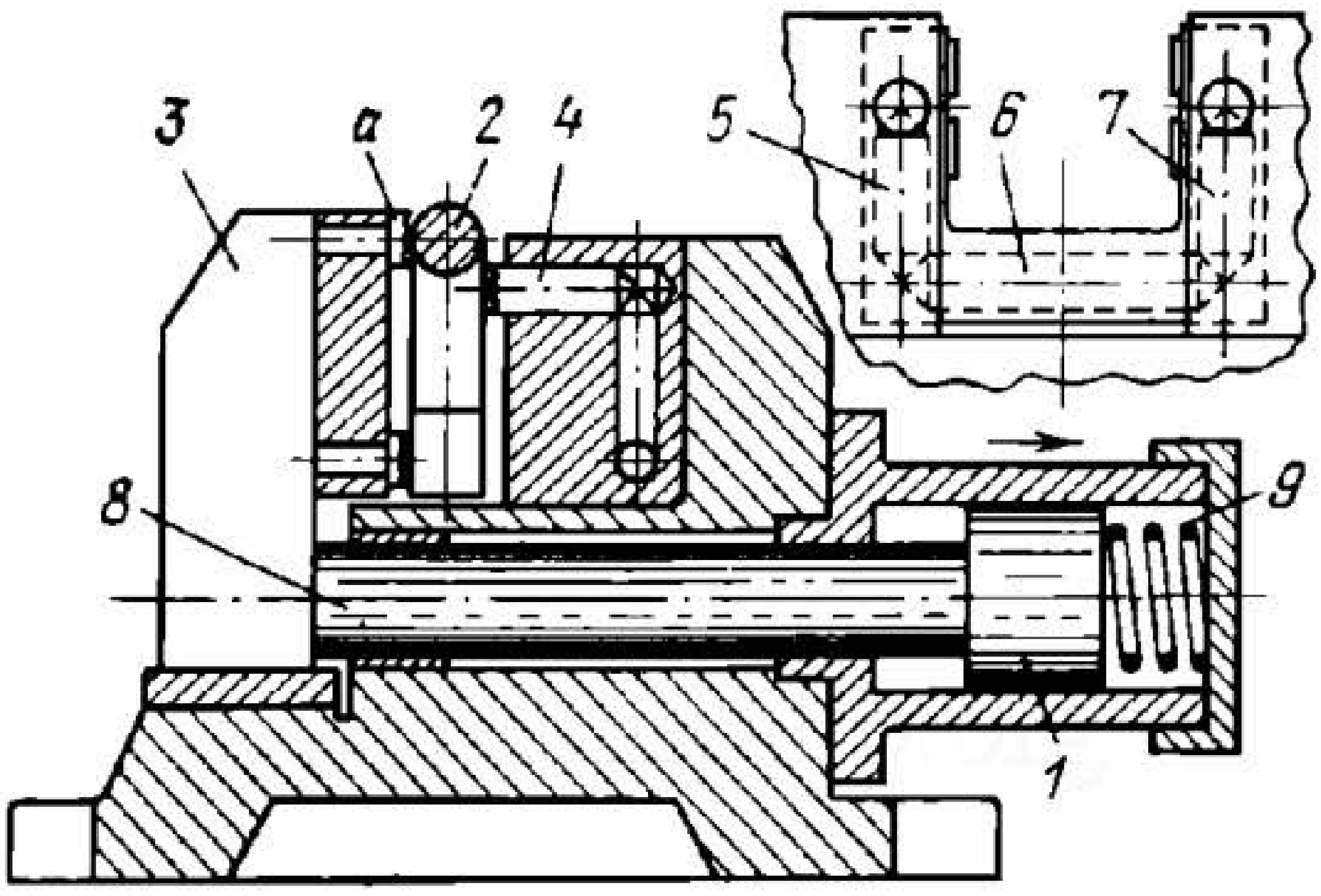
When piston *1* moves to the left by the action of fluid, work *2* is clamped. Work *2* is put on pin *a* of piston rod *3*. Here yoke *4* is the stationary jaw, and rod *3* the movable jaw. As piston *1* is moved to the right by spring *5*, work *2* is released.

3740	HYDRAULIC VISE MECHANISM	SHP GC



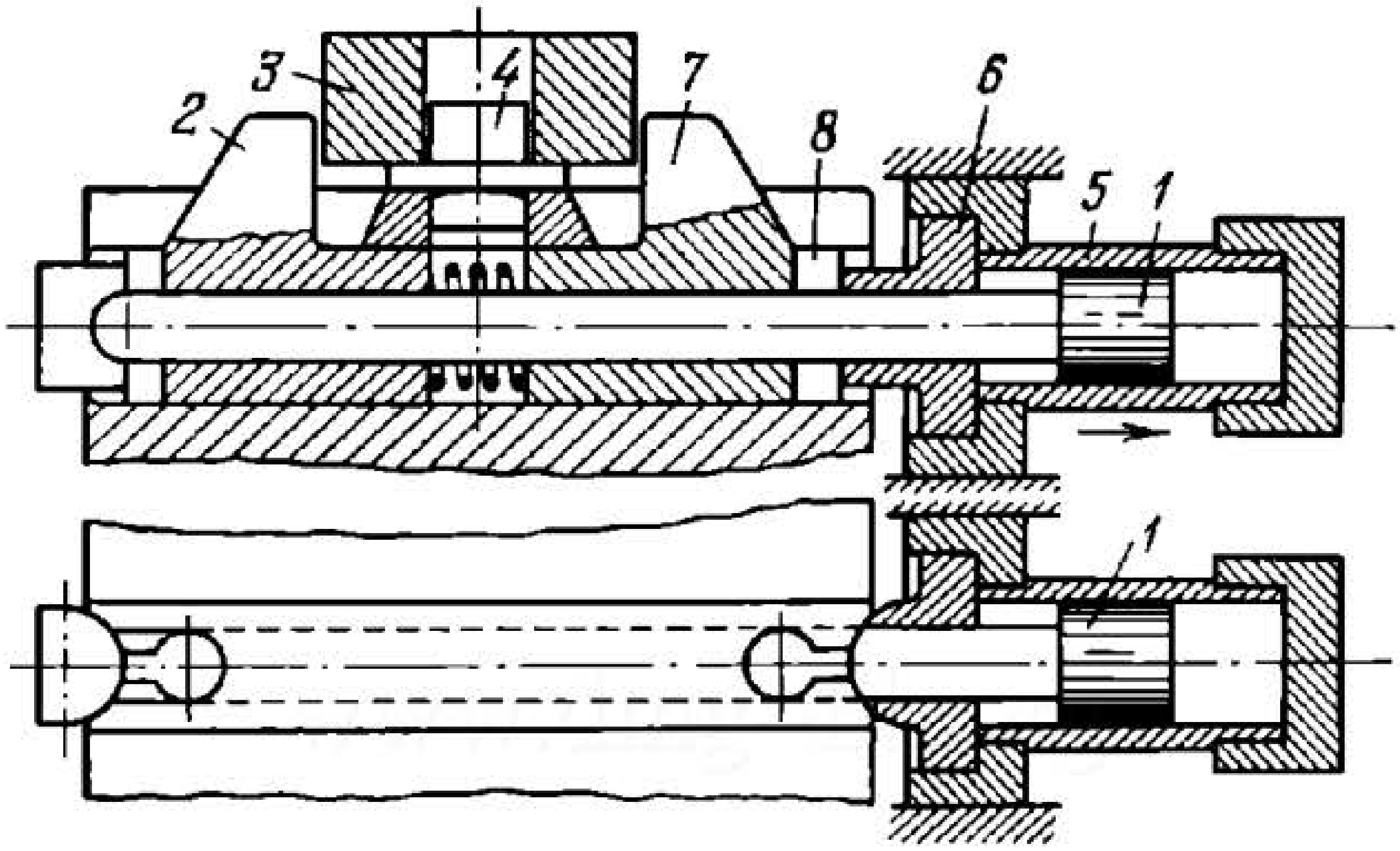
When piston *1* is moved to the right by fluid entering its cylinder, movable jaw *2* slides along guide *7*, clamping workpieces *3* which are mounted on arbor *4*. The ends of arbor *4* enter bushings *5* and *6*, fitted into movable jaw *2* and stationary jaw *10*. Fluid is delivered to the cylinder along channel *d* from selector valve *8*. Workpieces *3* are released when piston *1* is moved to the left by spring *9*.

3741	HYDRAULIC VISE MECHANISM WITH FLOATING CLAMPING PINS	SHP GC

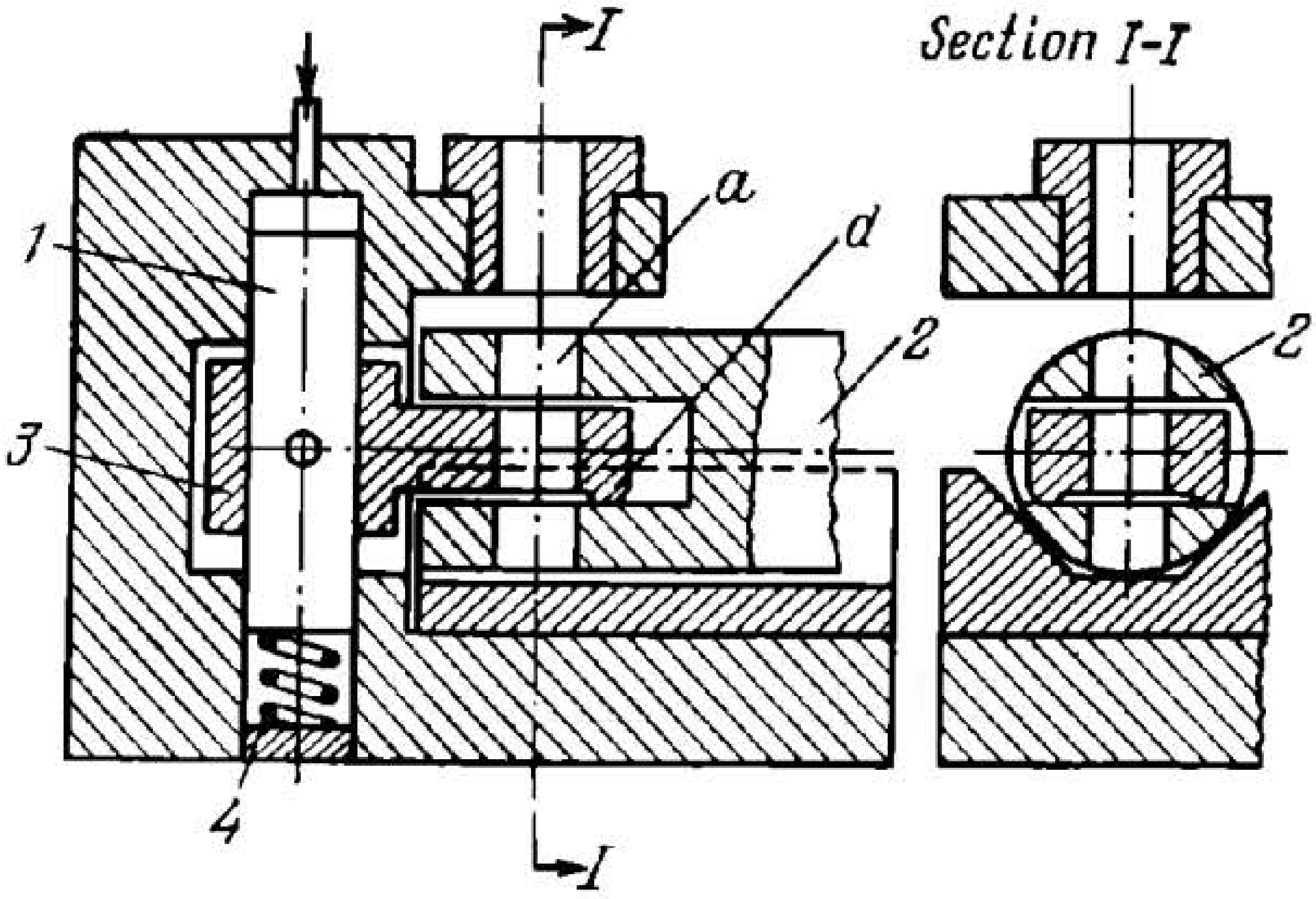


When piston 1 is moved to the right by fluid entering its cylinder, V-shaped workpiece *2* is clamped by movable jaw *3* which is rigidly linked to piston rod *8*. Workpiece *2* is clamped against three locating pins *a* of movable jaw *3* by means of two self-equalizing pins *4*. The pins are equalized upon variations in workpiece diameter by means of three floating pins *5*, *6* and *7* with conical ends that bear against one another. Workpiece *2* is released when piston *1* is moved to the left by spring *9*.

3742	FLOATING-CYLINDER HYDRAULIC VISE MECHANISM	SHP GC

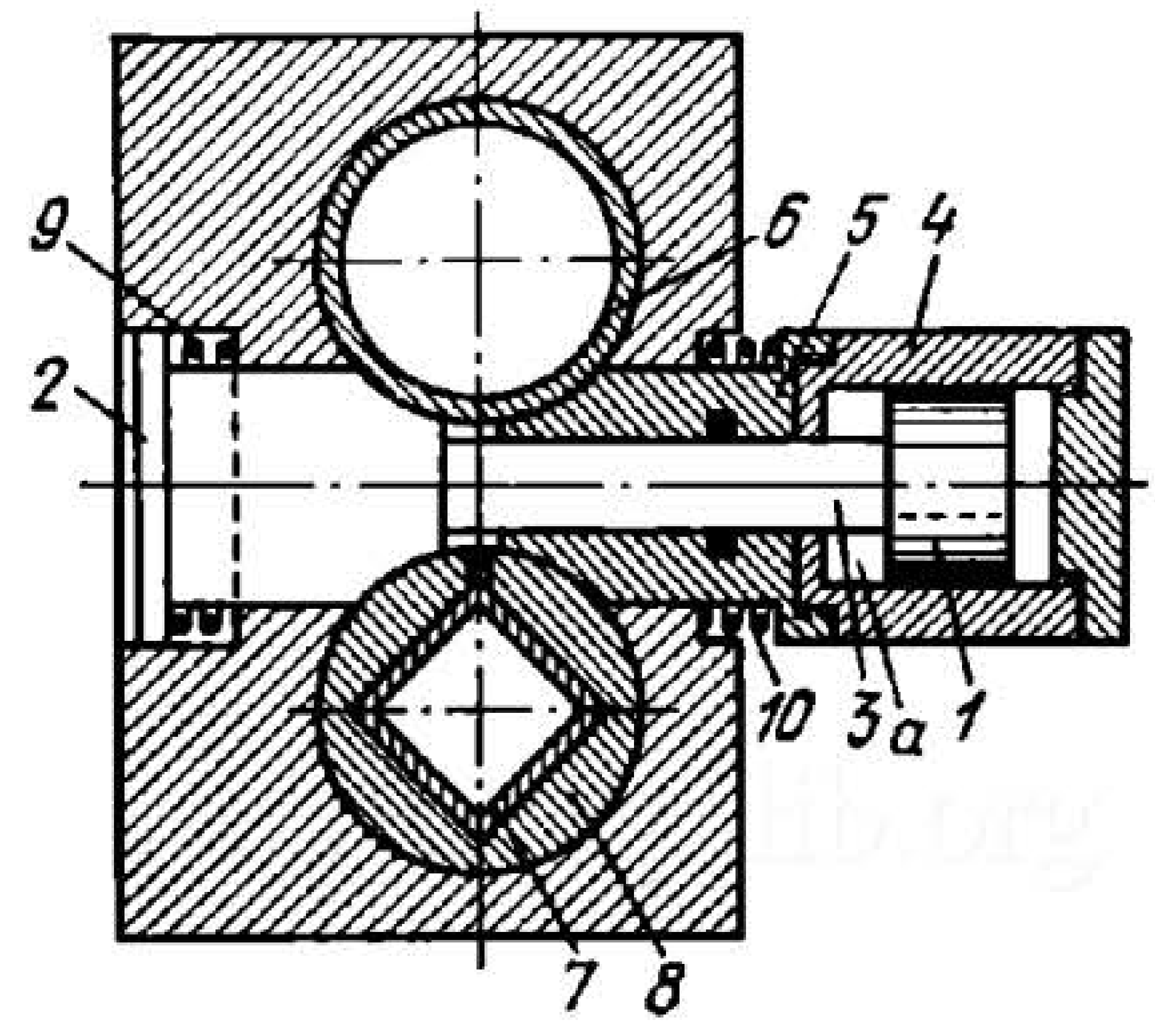


When piston *1* is moved to the right by fluid entering the left end of cylinder *5*, movable jaw *2* clamps workpiece *3* which is mounted on fixed locating pin *4*. At the same time, the action of the fluid moves cylinder *5* with wedge member *6* to the left, clamping workpiece *3* with the second movable jaw 7. When the workpiece is clamped, wedge member *6* and a similar wedge member at the left end of the piston rod spread spring members *8* at the ends of the movable jaws, thereby jamming the jaws in their guides.



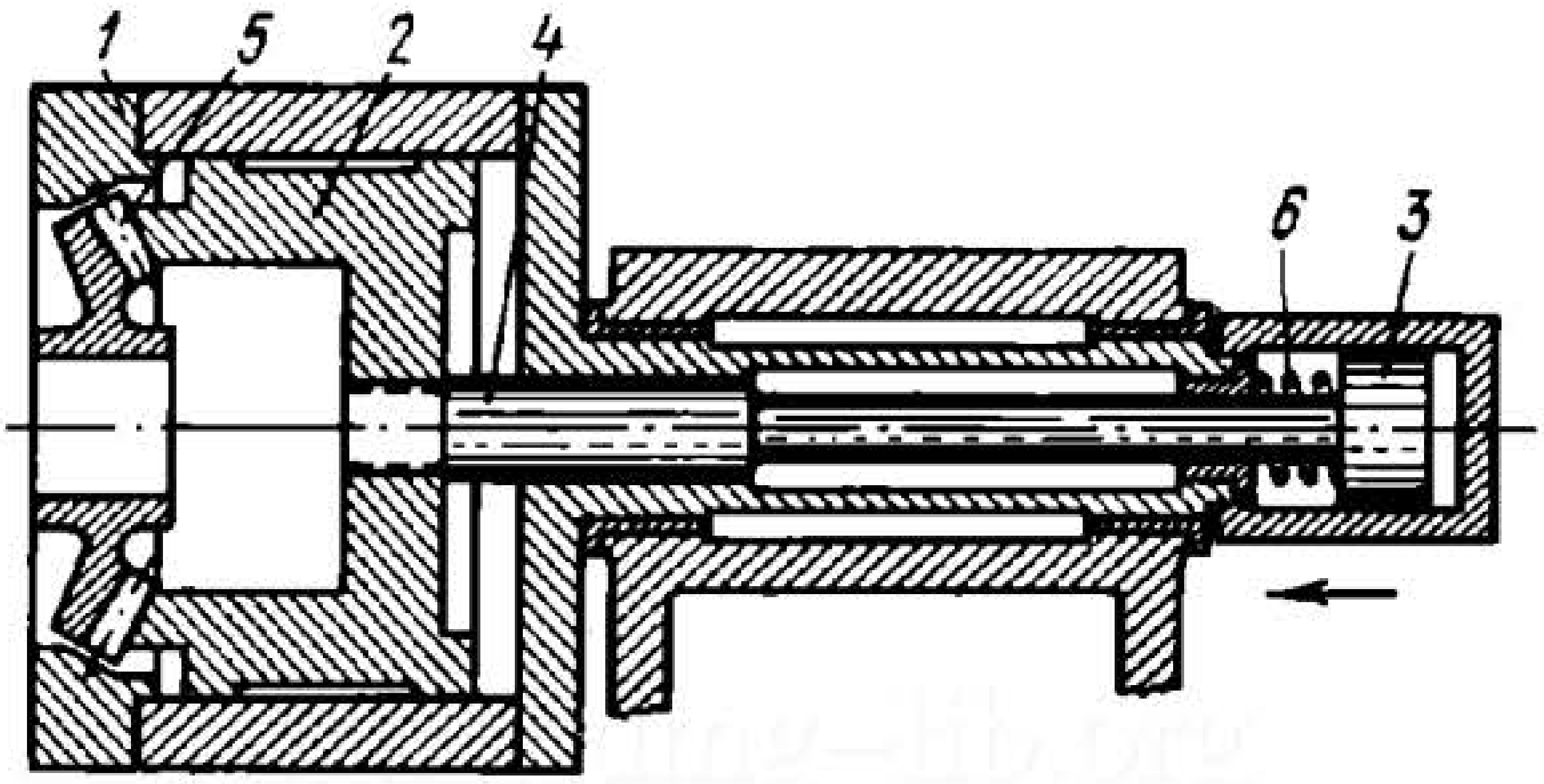
When plunger *1* is moved downward by fluid entering above it, clamping member *3*, mounted rigidly on plunger *1*, clamps round workpiece *2* in a V-block. The axis of plunger *1* is parallel to hole *a* to be machined in workpiece *2*. Locating points *d* of member *3* are in a plane perpendicular to the axis of hole *a*, locating the workpiece with its slot perpendicular to the axis of the guide bushing. Workpiece *2* is released and plunger *1* is returned to its initial position by spring *4*.

3744	HYDRAULIC CLAMPING MECHANISM FOR THIN-WALLED WORKPIECES	SHP GC



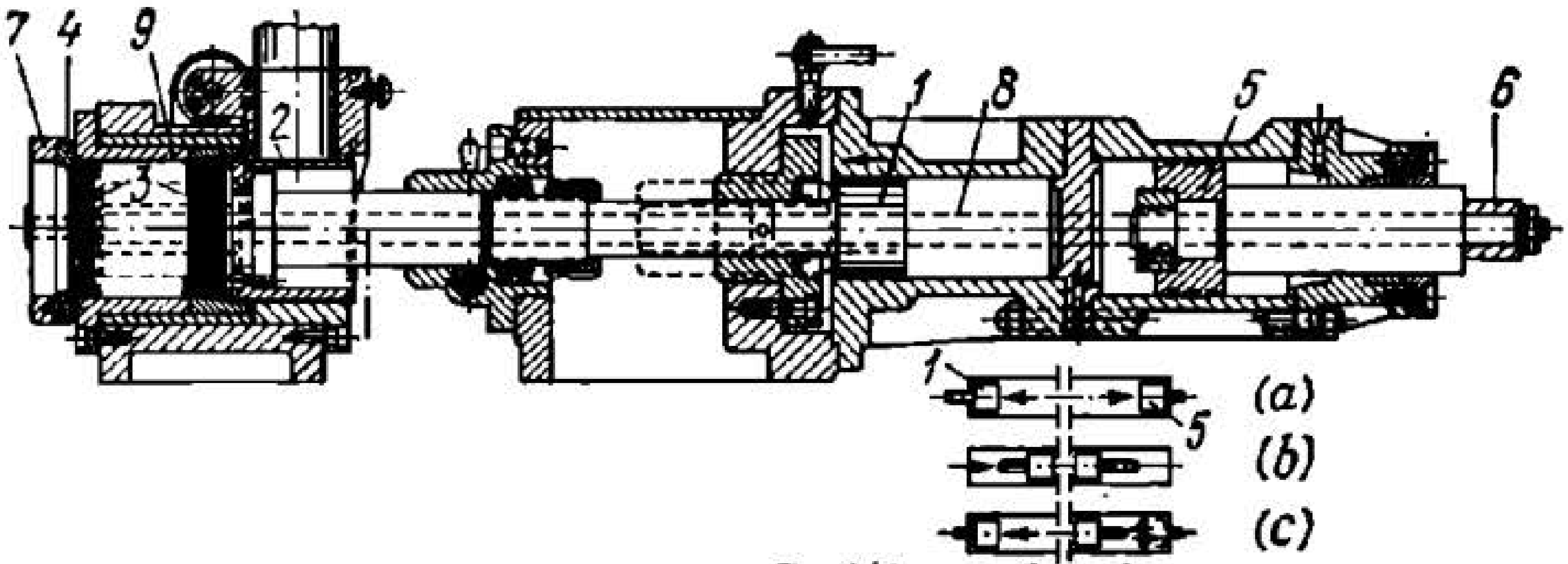
When piston *1* is moved to the right by fluid entering left end *a* of cylinder *4*, clamping member *2*, linked rigidly through rod *3* to piston *1*, and bushing *5*, secured rigidly to cylinder *4*, simultaneously clamp two thin-walled hollow workpieces *6* and 7. Both clamping member *2* and bushing *5* have cylindrical clamping surfaces of the same radius as the surfaces they clamp. In machining workpieces other than cylindrical (of hollow square shape as shown), they are clamped through split bushing *8* having an inner cross section corresponding to that of the workpiece. The workpieces are released by the action of springs *9* and *10*, with the fluid draining from end *a* back to the tank.

3745	HYDRAULIC CHUCK MECHANISM FOR CLAMPING BEVEL GEARS	SHP GC



Bevel gear *5* is inserted into the chuck through a slot in ring *1* and is located on the addendum cone in ring *2*. When piston *3* is moved to the left by fluid entering the right end of its cylinder, ring *2*, linked rigidly to piston *3* through rod *4*, clamps bevel gear *5* against ring *1*. Gear *5* is released when piston *3* is moved to the right by spring *6*.

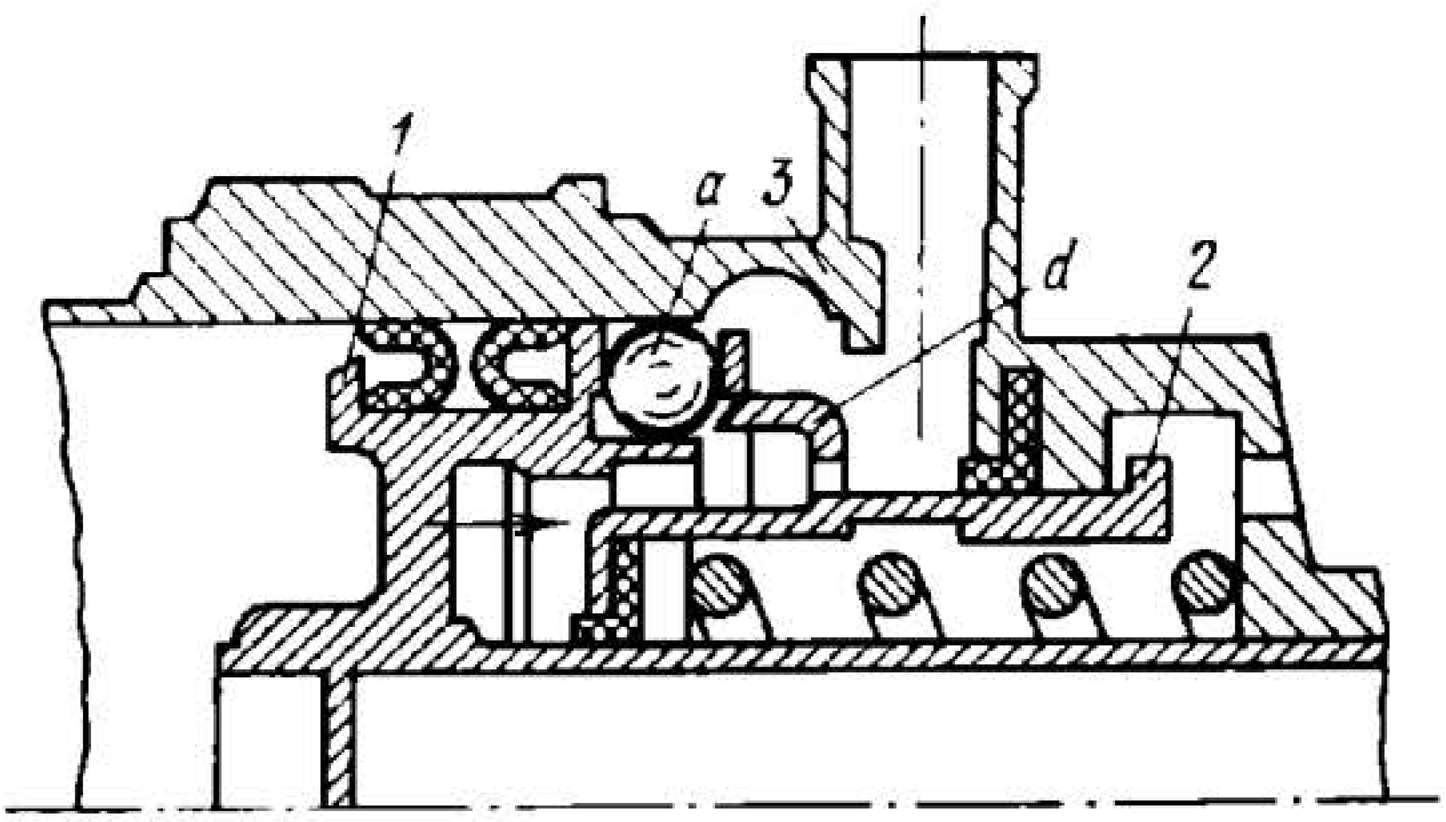
3746	HYDRAULIC CLAMPING MECHANISM FOR PISTON RINGS	SHP GC



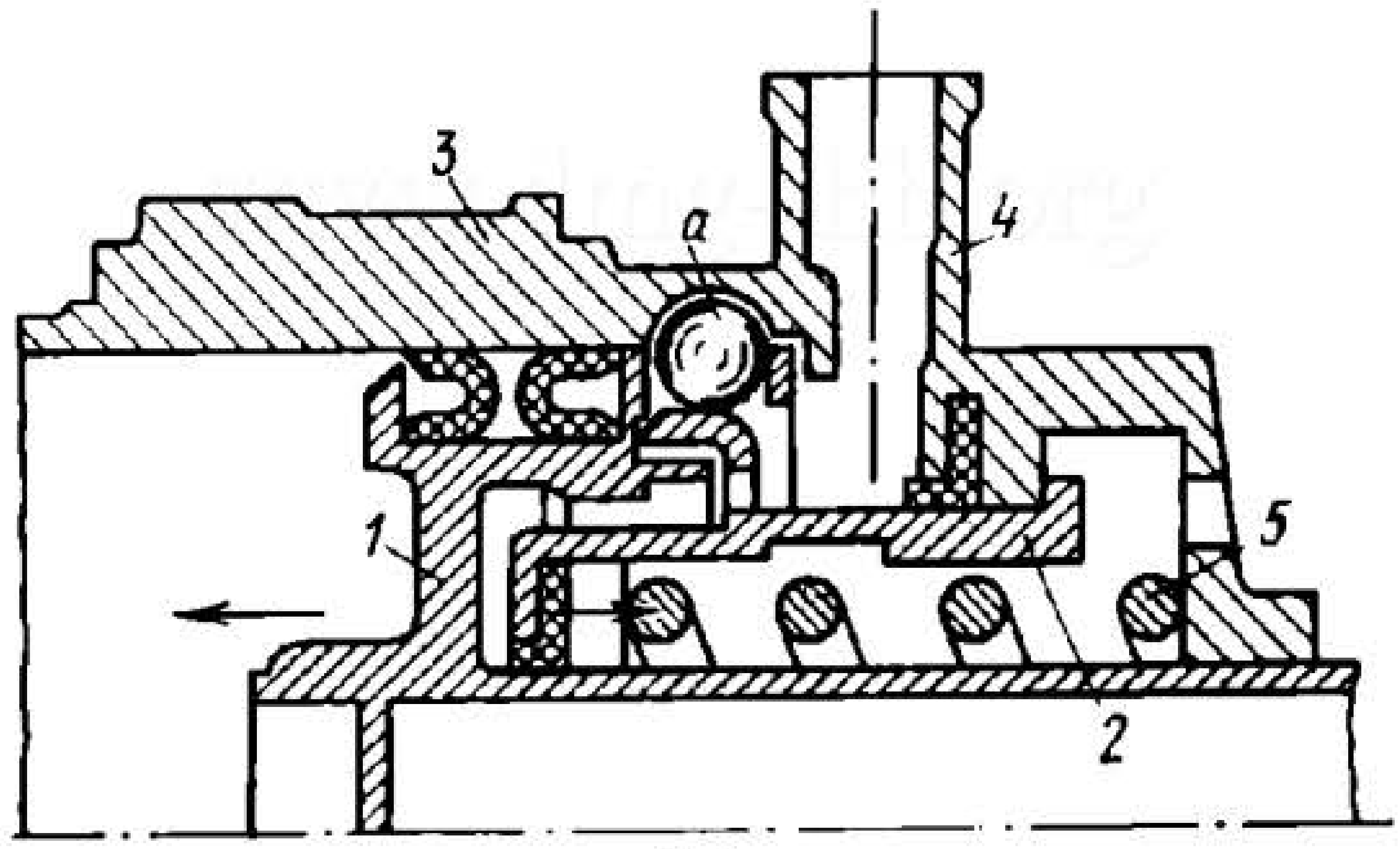
Positions of pistons

When piston *1* is moved to the left by fluid entering the right end of its cylinder, sleeve *2*, rigidly linked to the rod of piston *1*, clamps piston rings (workpieces) *3* against locating ring *4* (in the extreme left-hand position of piston *1*). When piston *5* is moved to the right by fluid entering the left end of its cylinder, clamping plate 7 and ring *4*, linked to the rod of piston *5* by cross-piece *6* and two tie-rods *8*, are pushed against sleeve *9* (in the extreme right-hand position of piston *5*). At this time, when the pistons are in position *a*, the piston rings are machined. At the end of the machining operation, piston *1* with sleeve *2* moves to their extreme right-hand position and the newly loaded piston rings drop downward to the spindle axis. At this, piston *5* moves to its extreme left-hand position (see position *b*). Then piston *1* moves to the left to the end of its stroke, pushing the newly loaded rings to the working position in which they eject the machined rings (see position *c*). After this, piston *5* moves to the right, clamping the rings. New rings are put into the loading position during the machining operation.

3747	HYDRAULIC BALL-TYPE LOCKING MECHANISM FOR AN AIRCRAFT LANDING GEAR	SHP GC

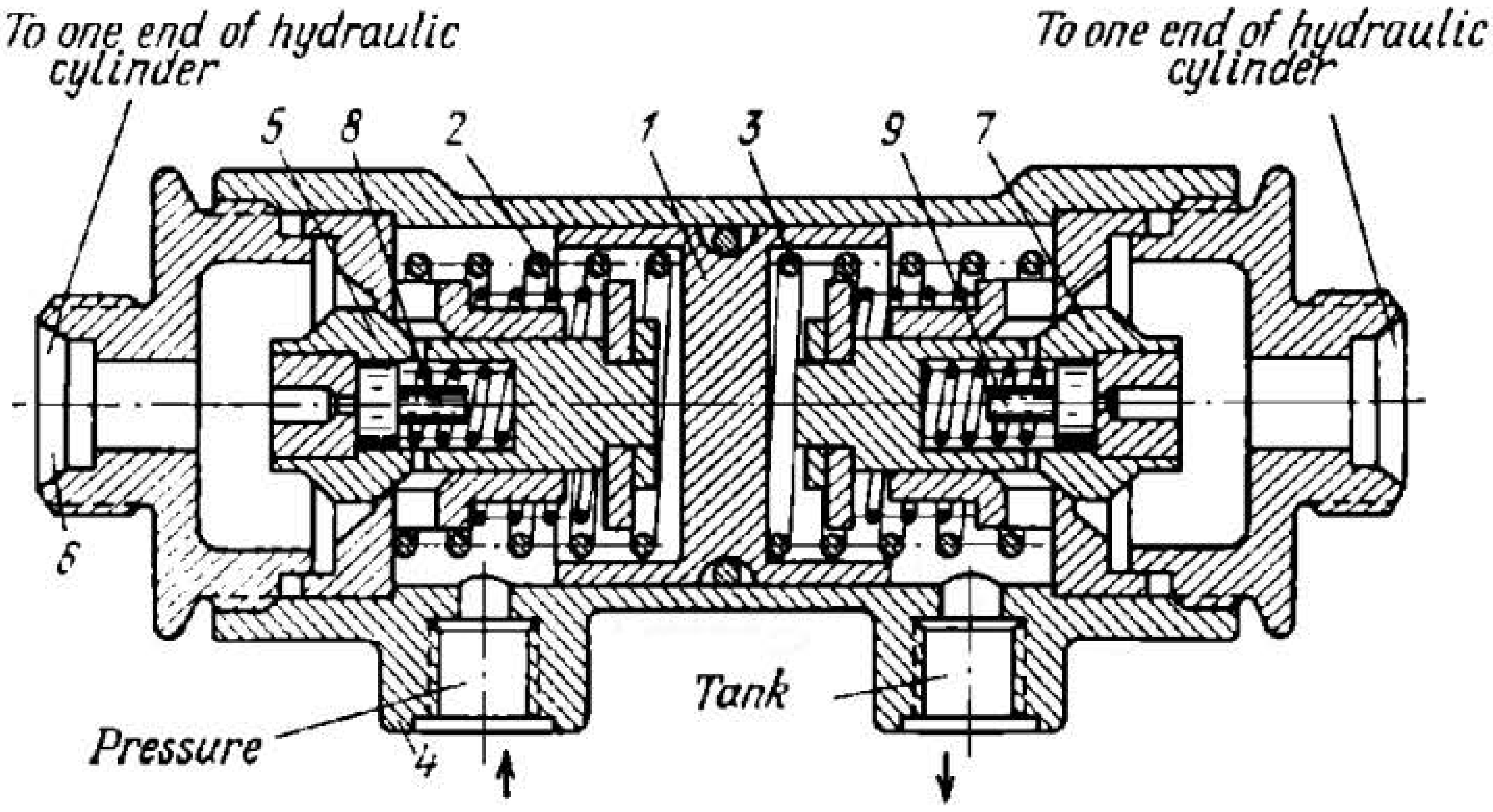


(a)



(b)

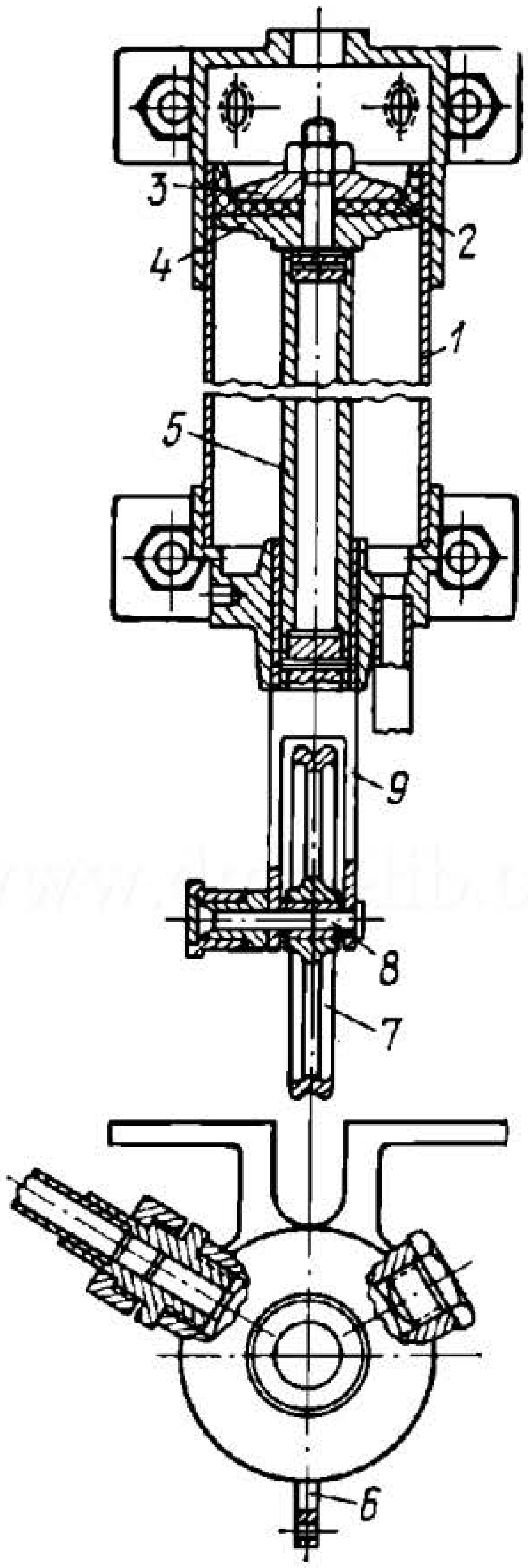
When piston 1 is moved to the right by fluid entering the left end of cylinder 3, balls a, held in a special cage of the piston, are forced outward by bevelled member d of plunger 2 and enter an annular groove of cylinder 3, locking piston 1 in the cylinder (see Fig. a). To open the lock, fluid under pressure is delivered through passage 4 (see Fig. b) into the space between piston 1 and plunger 2. This moves plunger 2 to the right, compressing spring 5 and releasing balls a. Then piston 1 is moved by the fluid to the left.



Floating piston *1* is held in the neutral central position by springs *2* and *3*. Fluid entering through port *4* opens left-hand check valve *5* and passes through port *6* to the working end of a hydraulic cylinder. At this, right-hand check valve *7* is moved to the right by piston *1* and the exhaust end of the hydraulic cylinder is connected to the tank. As soon as fluid delivery ceases, piston *1* is returned to its neutral position by springs *2* and *3*, valves *5* and *7* close and lock the position of the piston in the hydraulic cylinder. Valves *8* and *9* are relief valves.

7. DRIVE MECHANISMS (3749 through 3758)

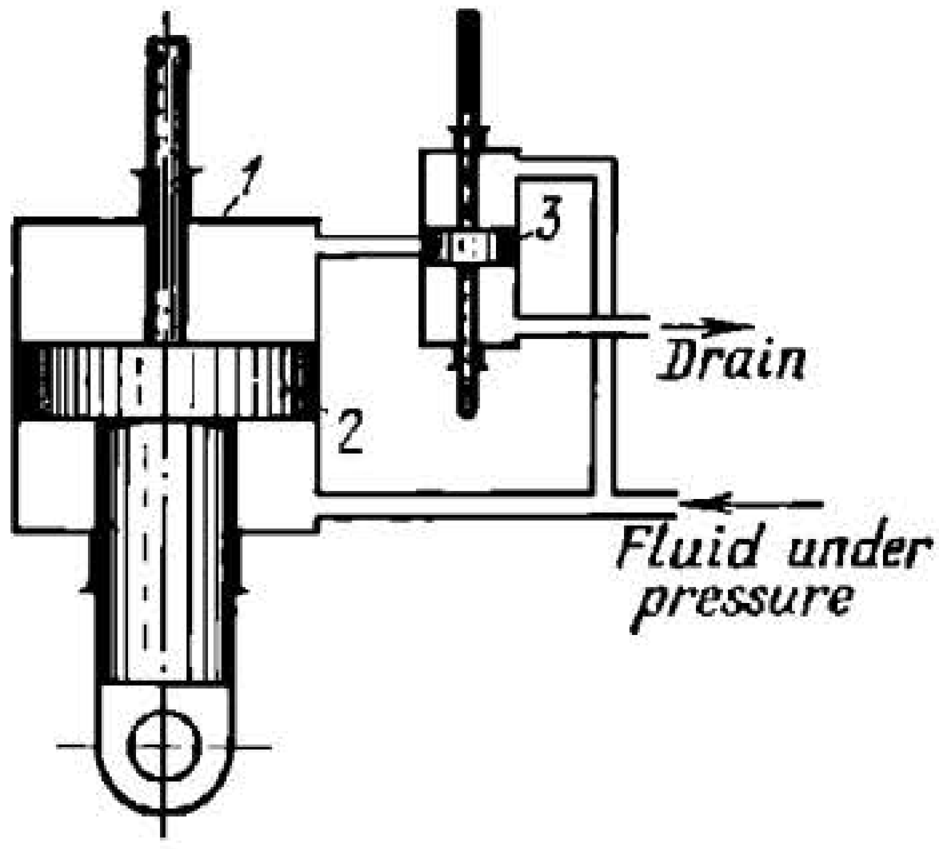
3749	PISTON-TYPE SERVOMOTOR MECHANISM	SHP Dr



Cylinder *1* contains a piston consisting of leather cup 2 clamped between disks *3* and *4*. The disks are secured to piston rod *5* at whose lower end clevis *9* is secured. The clevis has axle *8* on which roller 7 rotates. Screwed into the lower cover of cylinder *1* is eye *6* to which a cable is secured. The cable runs over roller *7* to the valve being controlled. When the pressure of the working fluid in the cylinder is changed, the piston is moved together with the clevis and roller *7*.

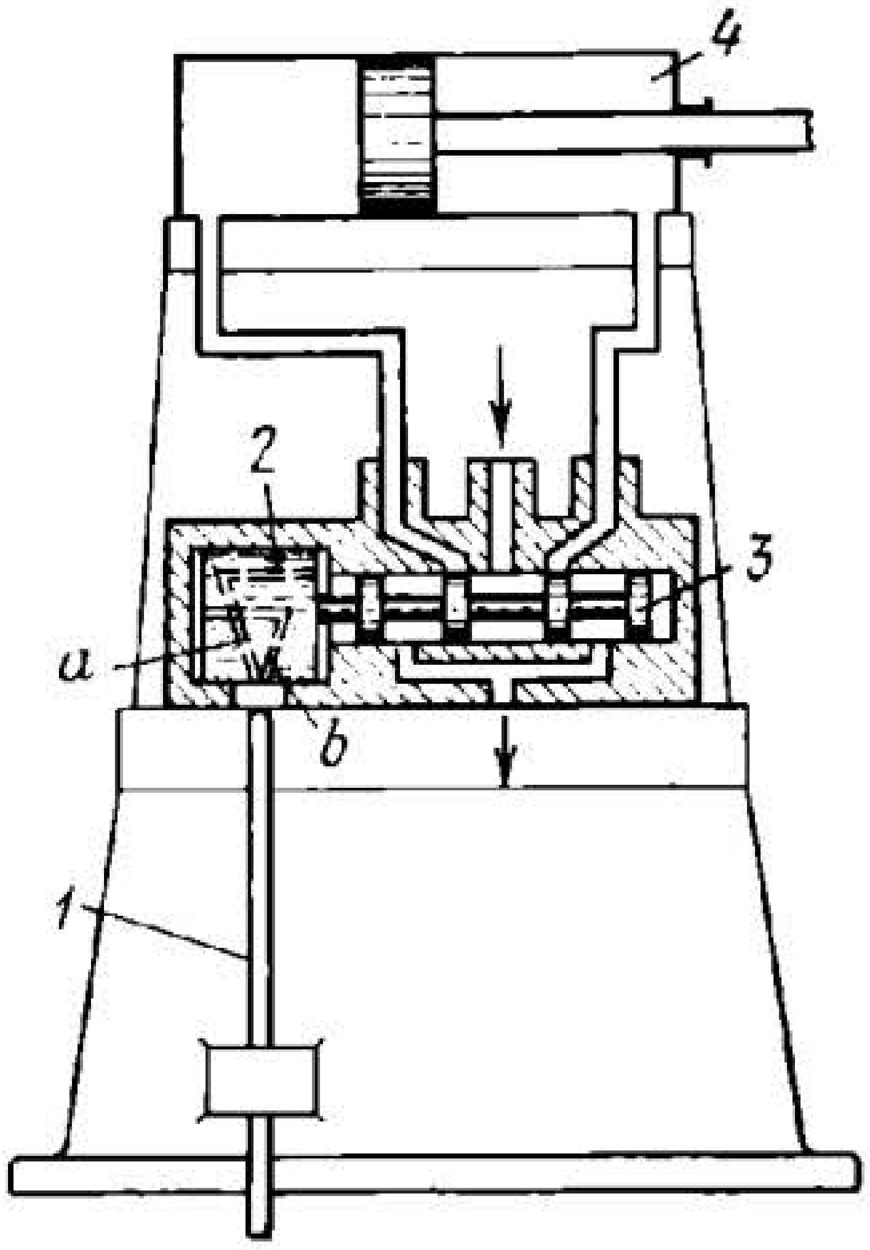
3750	**DIFFERENTIAL-ACTION SERVOMOTOR MECHANISM**	**SHP** **Dr**

Fluid under pressure is continually delivered to the lower end of differential servomotor *1* in which the effective areas above and below the piston differ. When valve spool *3* is shifted downward, fluid delivered to the valve is directed to the upper end of servomotor *1*. Owing to the difference in areas, piston *2* of the servomotor moves downward. When valve spool *3* is shifted upward, the upper end of the servomotor is connected to the tank and piston *2* moves upward due to the action of the constant pressure under the piston.

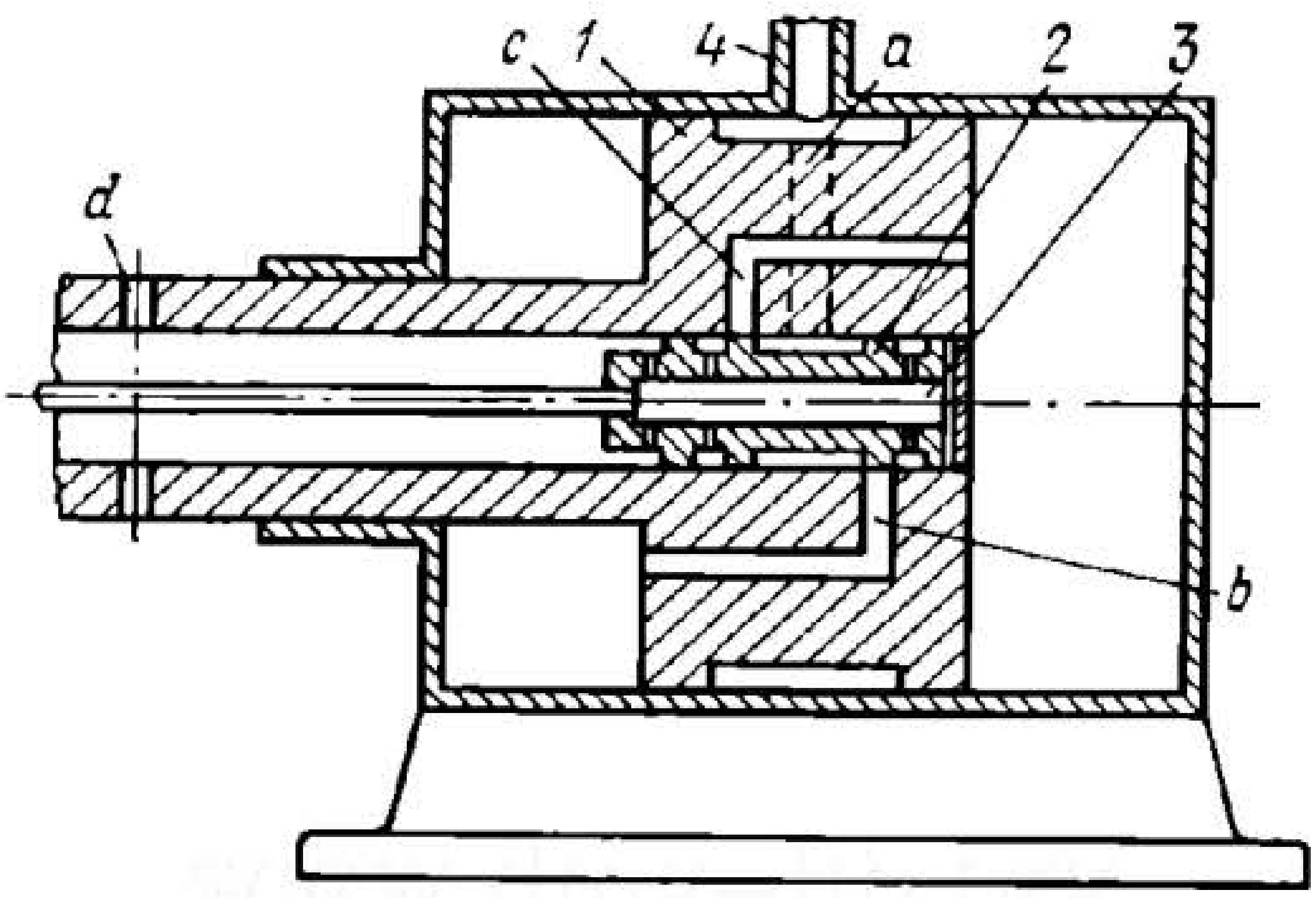


3751	**FLUID SECONDARY INTENSIFIER MECHANISM**	**SHP** **Dr**

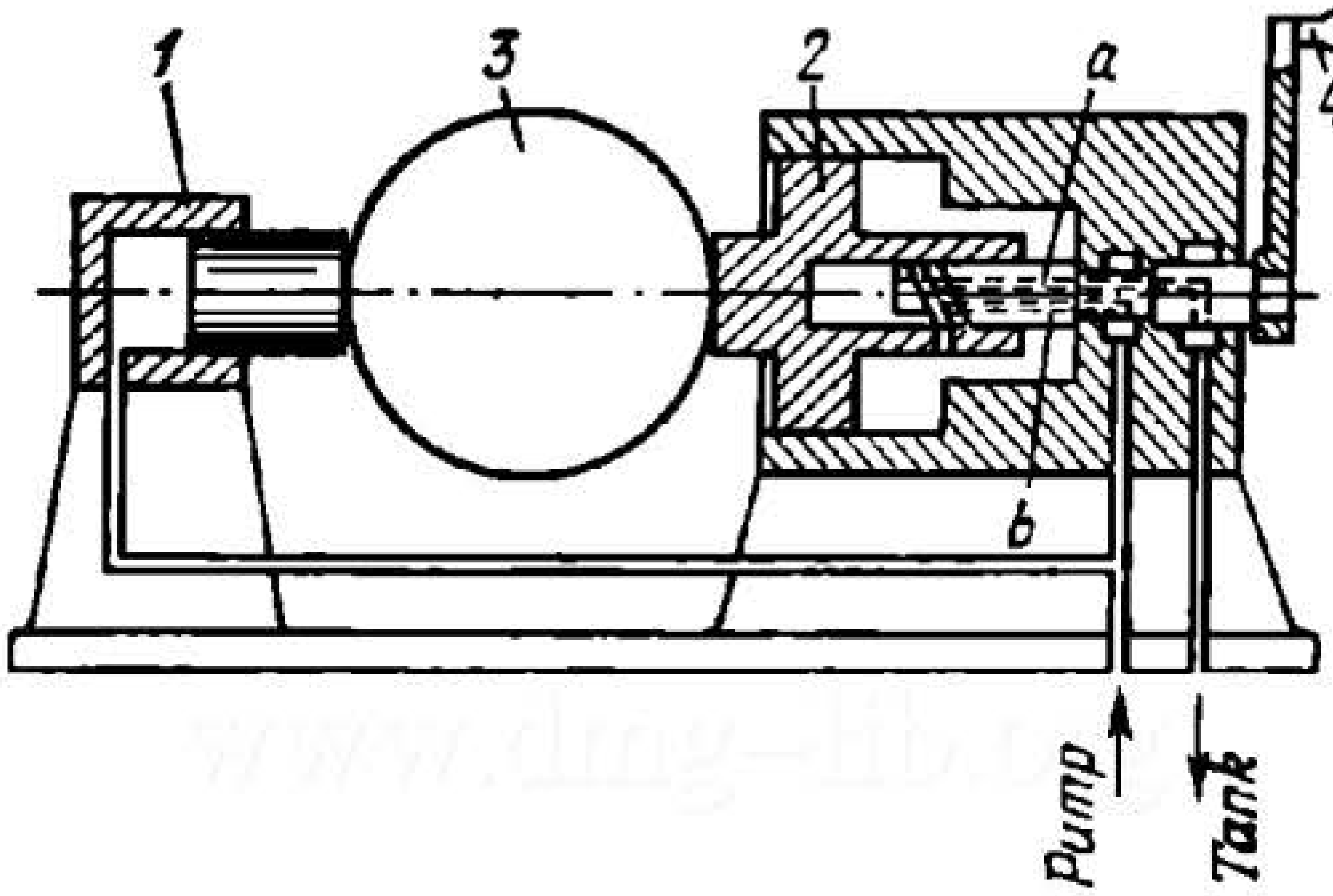
Piston *2* has two channels, *a* and *b*, that lead to the two ends of the piston. If jet valve nozzle *1* is in its middle position, the fluid pressure is the same at both ends of the piston and it remains stationary. If jet valve nozzle *1* is diverted from its middle position, equilibrium is disturbed and piston *2* moves in the direction the jet valve nozzle is inclined. At this, four-way directional valve *3* admits fluid to one or the other end of servomotor *4*.



3752	FLUID FOLLOW-UP CONTROL MECHANISM	SHP Dr

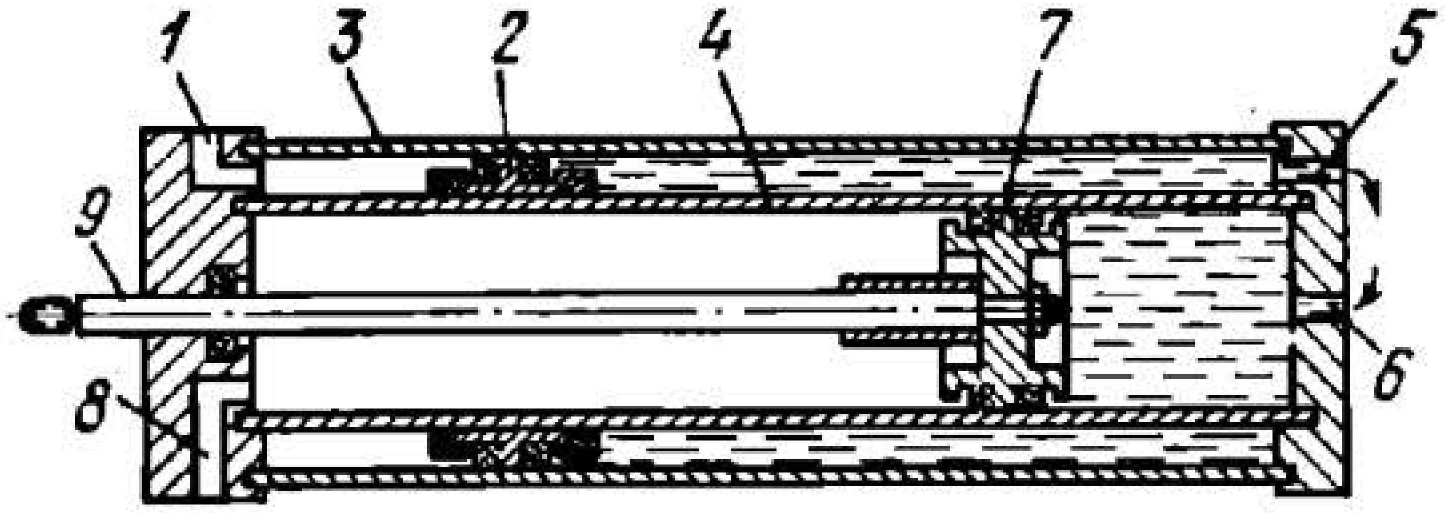


Fluid under pressure is delivered through port *4* to the annular groove of piston *1* from where it passes through radial hole *a* to the annular groove of valve spool *2*. This spool is shifted by stem *3* inside piston *1*. When the spool is shifted to the right, the fluid passes from the annular groove of spool *2* through channel *b* to the left end of the cylinder, moving the piston to the right as well. From the right end of the operating cylinder, the fluid passes through channel *c* in the piston to the left annular groove of spool *2* and through its radial and axial passages to the tank, passing through radial hole *d* in the rod of piston *1*. When the spool is shifted to the left, the piston moves in the same direction.



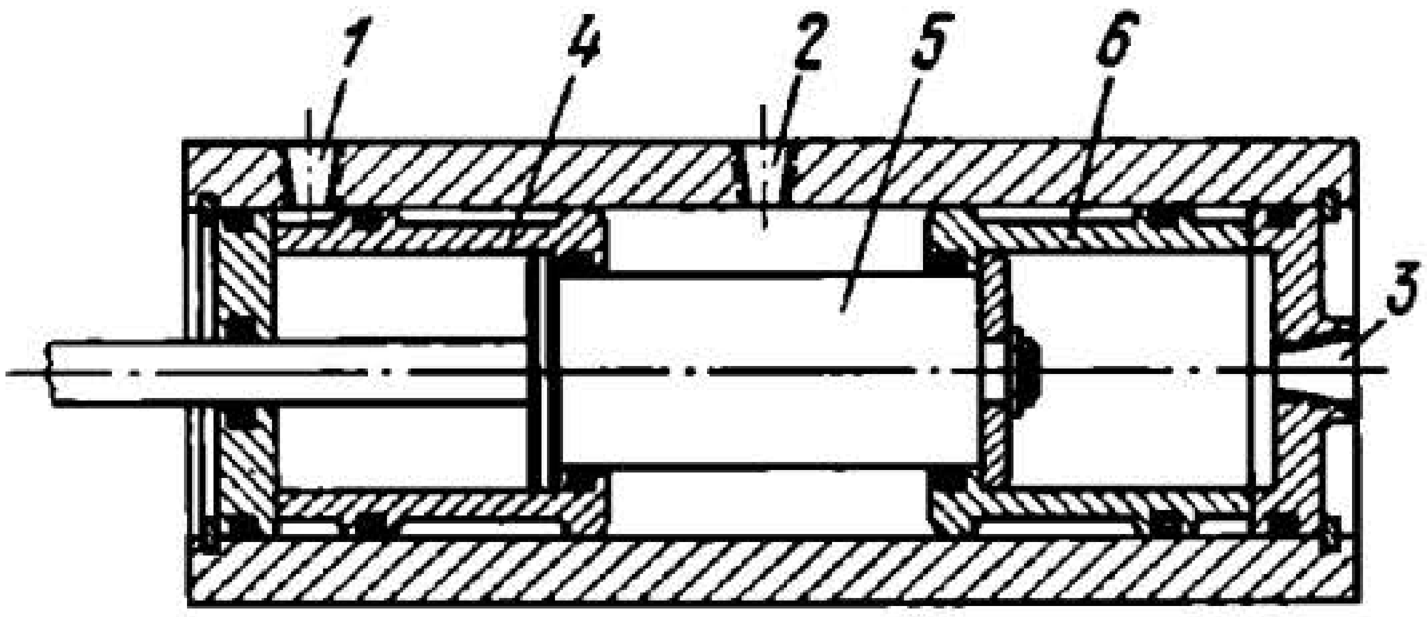
When fluid is delivered from the pump to cylinder *1*, the casing of pump *3* is moved to the right. At this, the end of the right-hand cylinder is connected through axial channel *a* to the tank. When crank *4* is turned, the end of the right-hand cylinder is connected to the pump through axial channel *b*, a helical groove on the spool and a radial hole in piston *2*. At this, the casing of pump *3*, owing to the difference in the effective areas of the pistons, is moved to the left.

3754	HYDROPNEUMATIC CYLINDER MECHANISM	SHP Dr



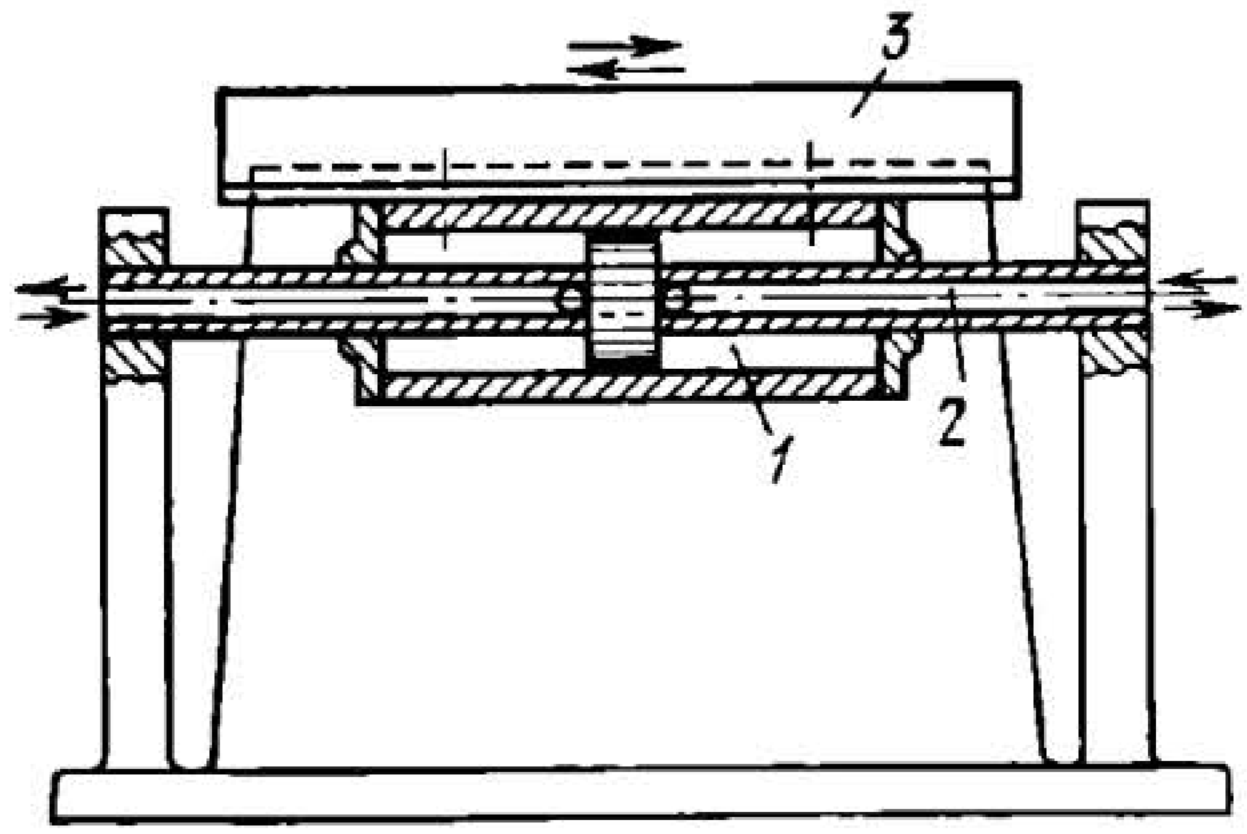
Compressed air from the mains is admitted by a directional device through port *1* into the annular cylinder formed by pipes *3* and *4*. At this, annular piston *2* moves to the right and liquid from the annular cylinder passes through ports *5* and *6* into the right end of the inner cylinder. Piston *7* moves to the left because port *8* is connected to the atmosphere. With this motion of piston *7*, piston rod *9* is extended. To provide for the required velocity of motion of piston *7* a regulating valve, not shown, is mounted in the pipeline between ports *5* and *6*. If the required velocity of motion of piston *7* is constant and the same for the forward and reverse strokes, the regulating valve may be a simple flow-control valve. In the reverse stroke, port *1* is connected to the atmosphere and compressed air is admitted into port *8*. Piston *7* moves to the right, and the liquid from the right end of the inner cylinder is forced through ports *6* and *5* into the right end of the annular cylinder, moving annular piston *2* to the left.

3755	PNEUMATIC THREE-POSITION CYLINDER MECHANISM	SHP Dr



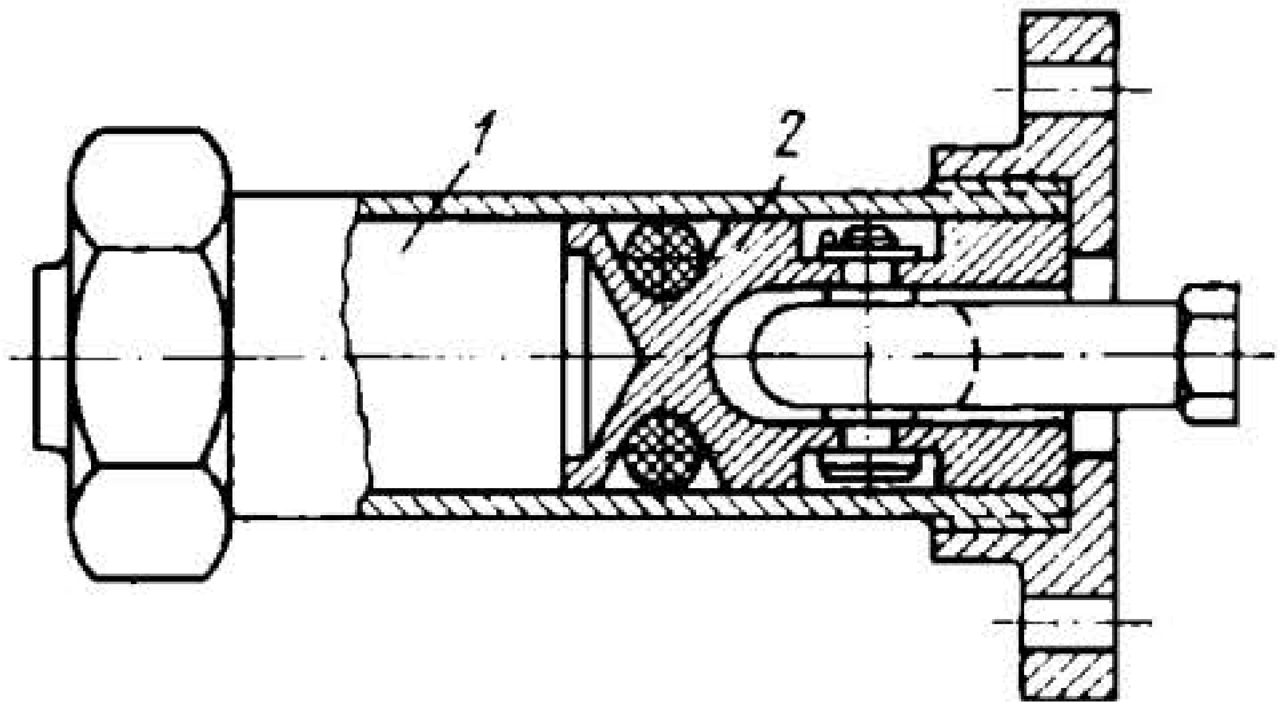
When compressed air is admitted into port *2* and ports *1* and *3* are connected to the atmosphere, the piston rod is set in its middle position. If compressed air is admitted through port *3* and ports *1* and *2* are connected to the atmosphere, pistons *5* and *6* move to the left and the rod is extended. If compressed air is admitted through port *1* and ports *2* and *3* are connected to the atmosphere, pistons *4* and *5* move to the right and the rod is retracted.

3756	STATIONARY-ROD HYDRAULIC CYLINDER MECHANISM	SHP Dr



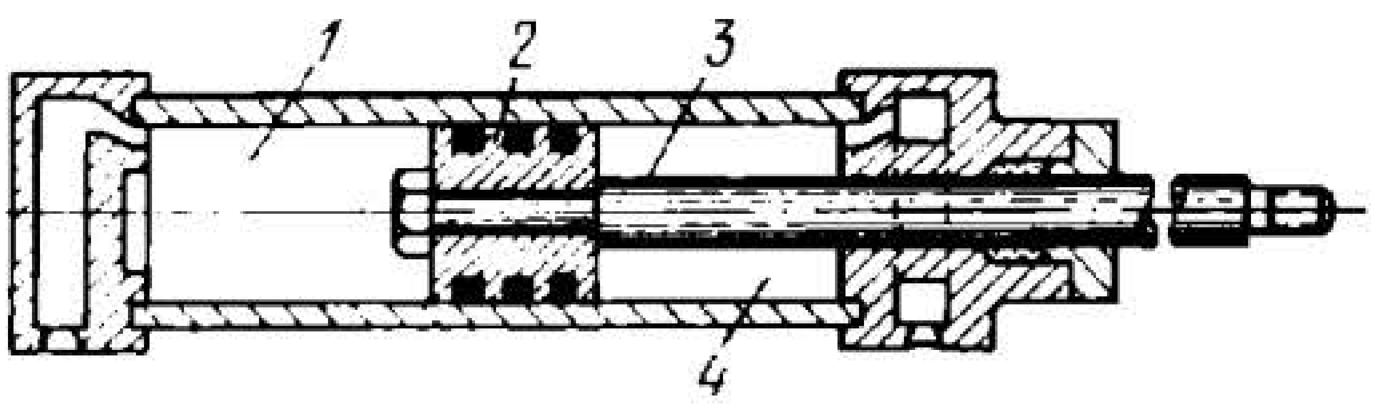
When fluid is admitted into the right end of cylinder *1* through an axial channel in stationary piston rod *2*, the cylinder, together with table *3* to which it is attached, travels to the right. When fluid is admitted into the left end of the cylinder, table *3* travels to the left.

3757	SINGLE-ACTING ACTUATING CYLINDER MECHANISM	SHP Dr



When the pressure of the fluid is raised in left end *1* of the cylinder, piston *2* moves to the right. It is returned to its initia position by a spring (not shown).

3758	DOUBLE-ACTING ACTUATING CYLINDER MECHANISM	SHP Dr

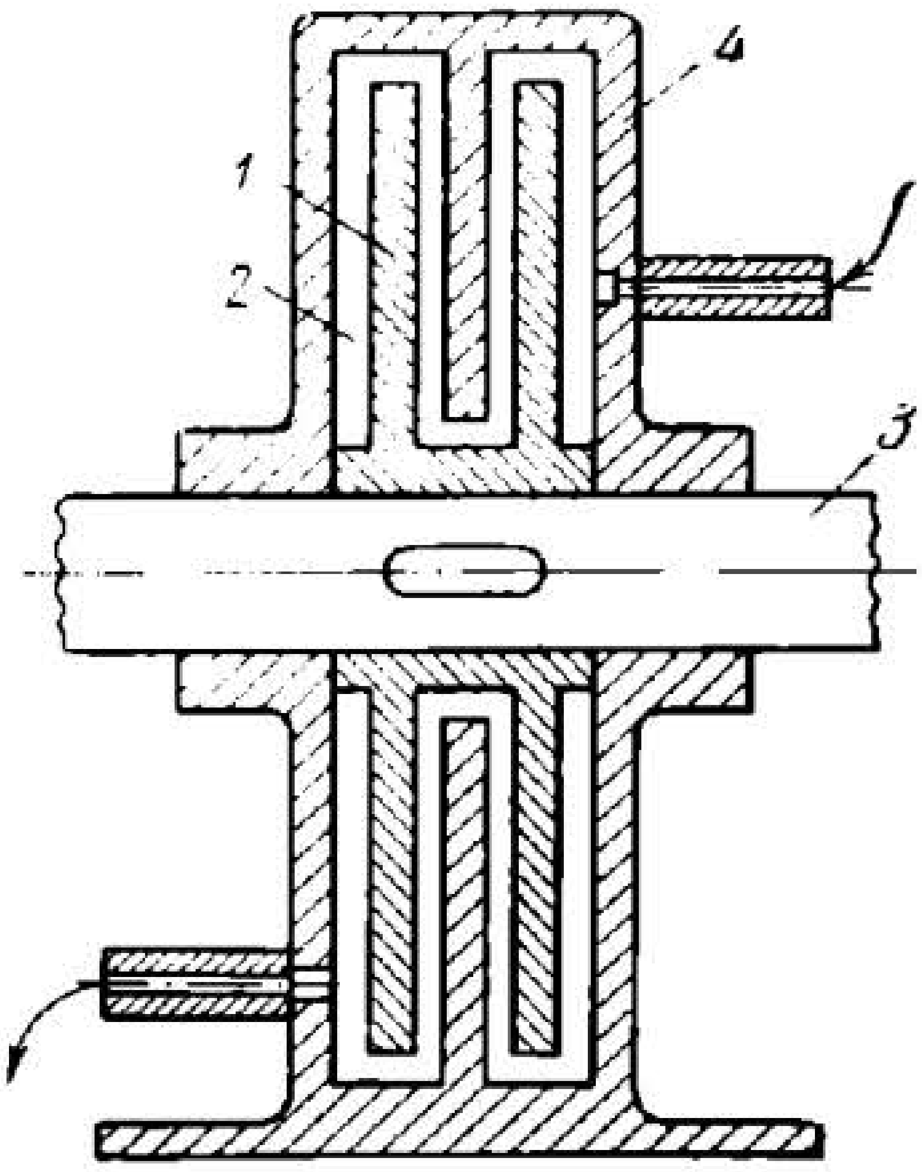


When the pressure of the fluid is raised in left end *1* of the cylinder, piston *2* moves rod *3* to the right and forces the fluid out of right end *4*. When the pressure is raised in end *4*, piston *2* moves rod *3* to the left.

8. BRAKE MECHANISMS (3759 through 3763)

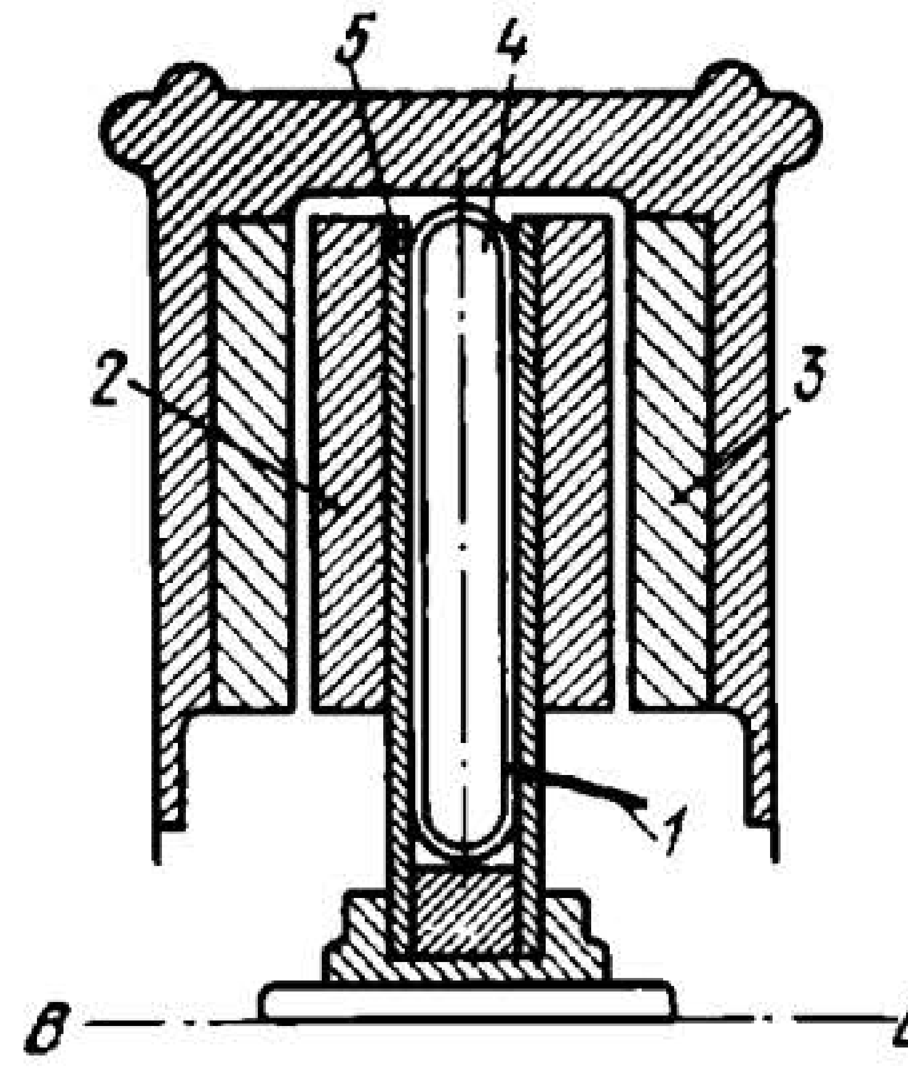
3759	HYDRAULIC BRAKE MECHANISM	SHP Br

Brake disks *1* are keyed on shaft *3*. Space *2* between the disks and the housing is filled with a liquid. The braking torque on shaft *3* is varied by filling space *2* with more or less liquid.

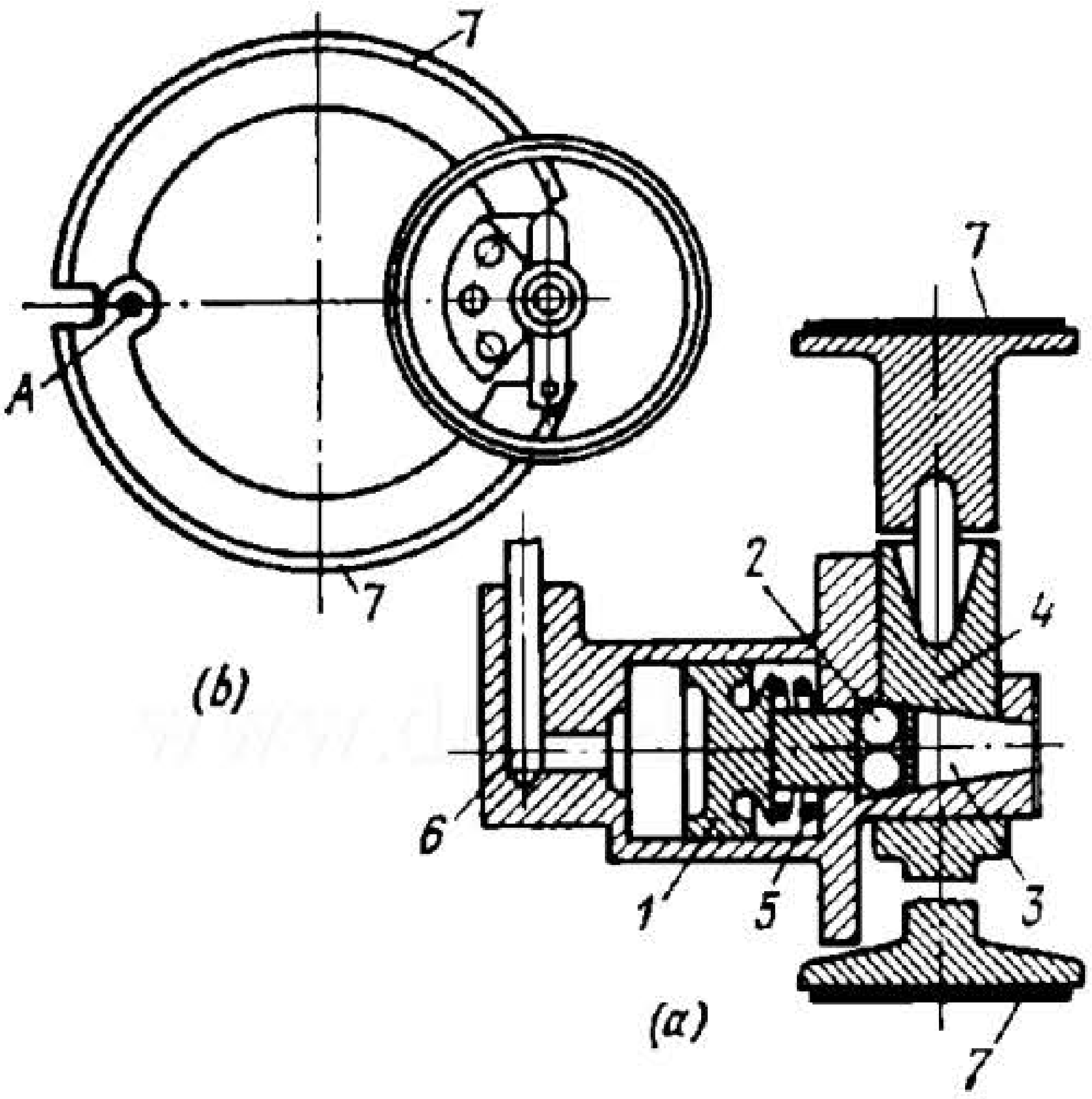


3760	ELASTIC-LINK HYDRAULIC BRAKE MECHANISM	SHP Br

Actuated by compressed air or oil admitted through hose *1* into elastic chamber *4*, this chamber forces stationary disks *2*, by means of flexible member *5*, against disks *3* rotating about fixed axis *B-B*. This brakes disks *3*.

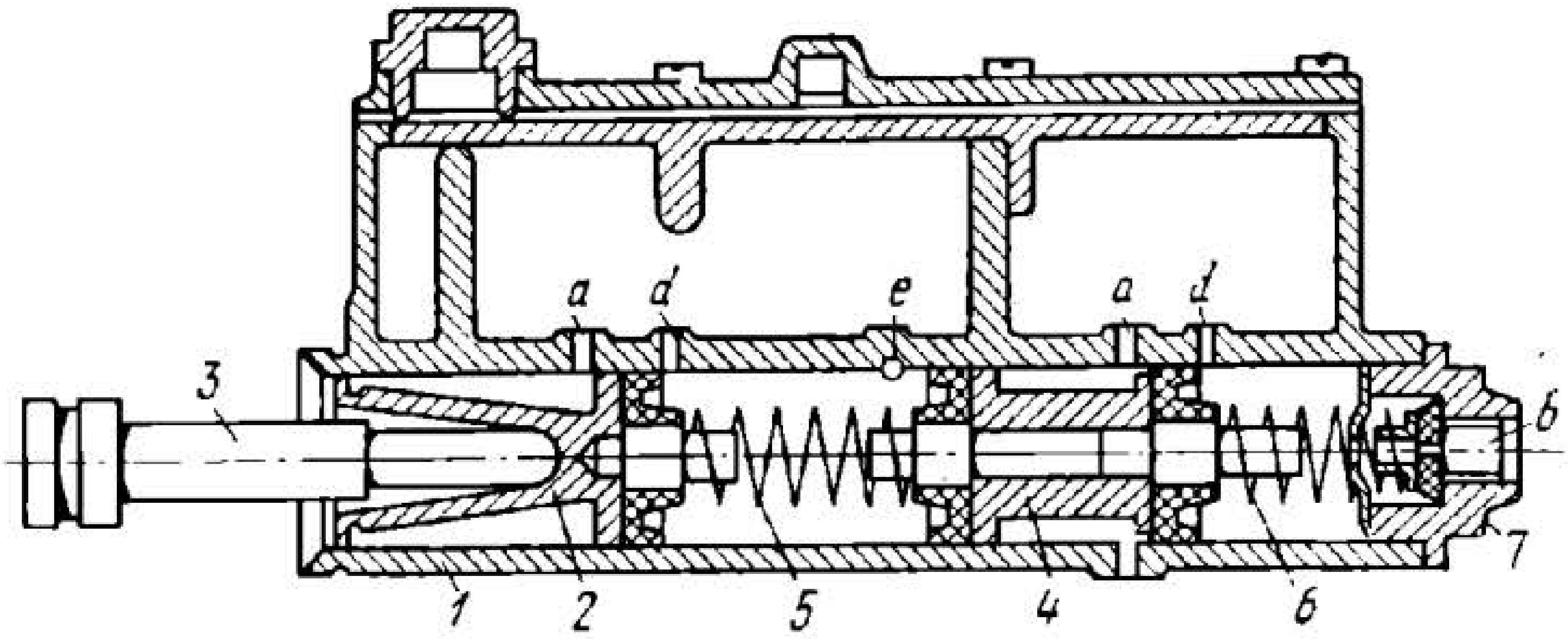


3761	PNEUMATIC FRICTION BRAKE MECHANISM	SHP Br



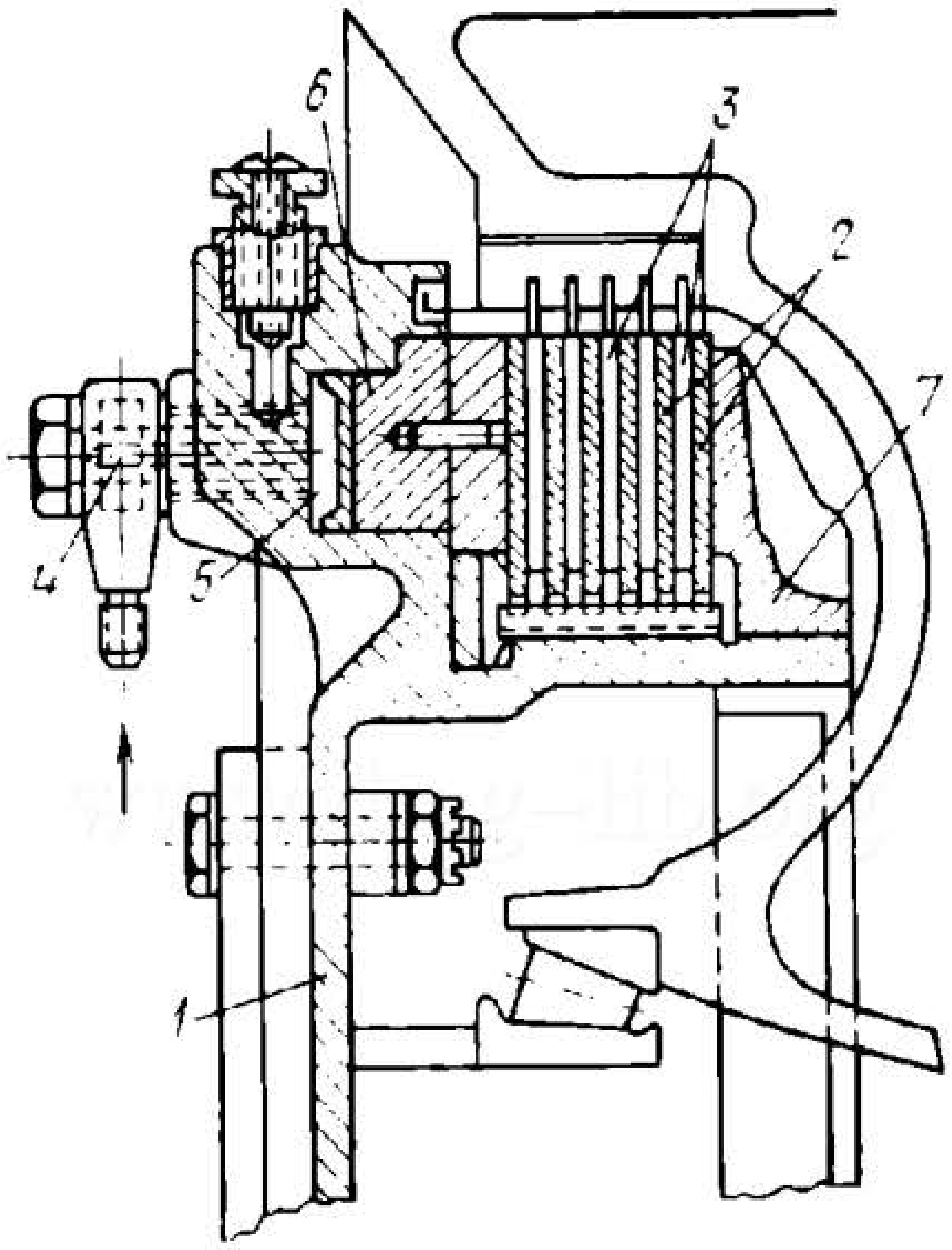
The action of compressed air (Fig. *a*), delivered through tube *6*, shifts piston *1* to the right, overcoming the resistance of spring *5*. This pushes balls *2* into conical space *3* which is limited by the surface of pusher *4*. As pusher *4* moves upward it spreads shoes *7* (Fig. *b*), turning them about axis *A*. The pneumatic elements of the mechanism are shown in an enlarged scale.

3762	DOUBLE HYDRAULIC CYLINDER BRAKE DRIVE MECHANISM	SHP Br



Moving in cylinder *1*, connected by ports *a* and *d* to the tank, are piston *2*, whose rod *3* is linked to the brake pedal, and piston *4*. When the brake pedal is depressed, fluid flows through channel *e* to the rear wheel brakes and through port *b* to the front wheel brakes. When the pedal is released, springs *5* and *6* move pistons *2* and *4* to the left, and fluid from the mains is admitted into main cylinder *1*. If there is a leak in the line leading to the rear brakes through channel *e*, or if the line is damaged the rear brakes fail to operate and piston *2* approaches and contacts piston *4*. Owing to the force exerted on rod *3*, the fluid flows through plug *7* to the front wheel brakes. If the leak is in the line leading to the front wheel brakes, these brakes fail to operate and the force exerted on the rod moves piston *2*. The pressure thus produced shifts piston *4* to the end of its stroke. Then the fluid in the space between the pistons is forced out through channel *e* to the rear wheel brakes. Ports *a* serve to admit fluid from the tank to the main cylinder. Ports *d* compensate for temperature changes in the volume of fluid, for leakage and surplus fluid, as well as for changes in the volumes of the operating cylinders of the brakes upon adjustments of the brakes.

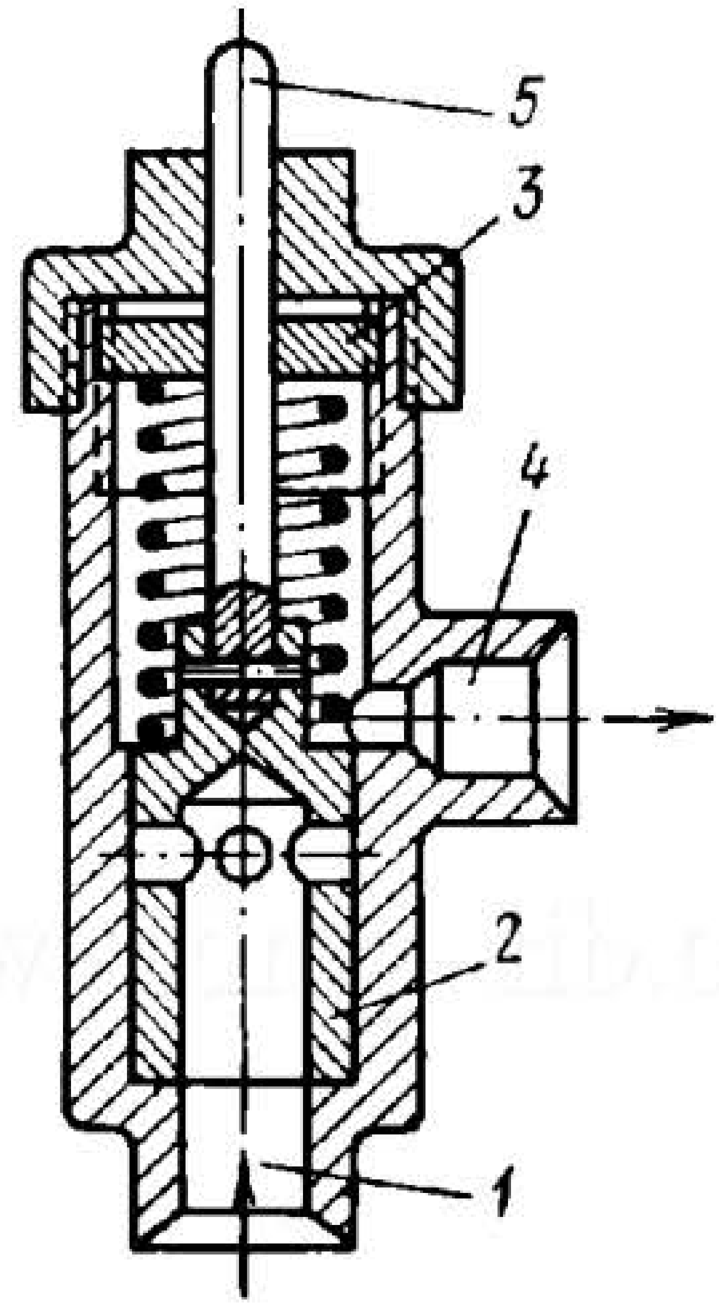
3763	HYDRAULIC FRICTION-DISK WHEEL BRAKE MECHANISM	SHP Br



Brake housing *1* contains six disks *2*, keyed to and having only axial motion in the housing, and five rotating disks *3* (alternating with disks *2*) keyed to the wheel being braked. Fluid under pressure is admitted through connection *4* into annular cylinder *5*, moving annular piston *6* to the right and thereby pressing the disks together to obtain the braking action. The disks are forced up against shaped washer *7*.

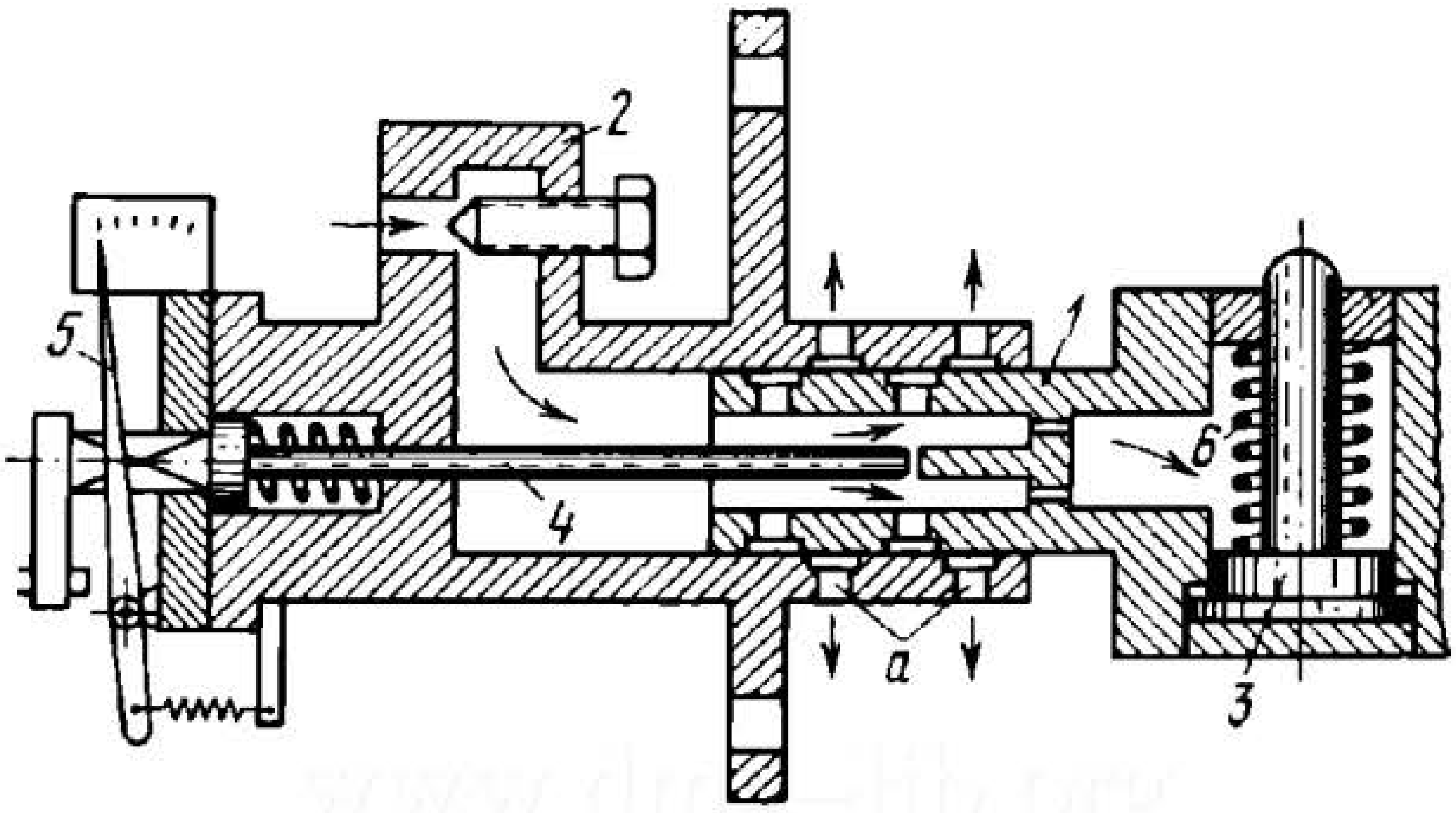
9. RELAY MECHANISMS (3764 and 3765)

3764	PRESSURE-RELAY MECHANISM FOR A PUMP DRIVE MOTOR	SHP Re



When the pressure of the fluid at port *1* exceeds the preset value, plunger *2* is raised, compressing a spring whose tension is adjusted by threaded member *3*, and surplus fluid drains through a hole in the plunger and port *4* to the tank. Raised together with the plunger is pusher rod *5*, linked to the plunger, which automatically switches the pump drive motor on or off.

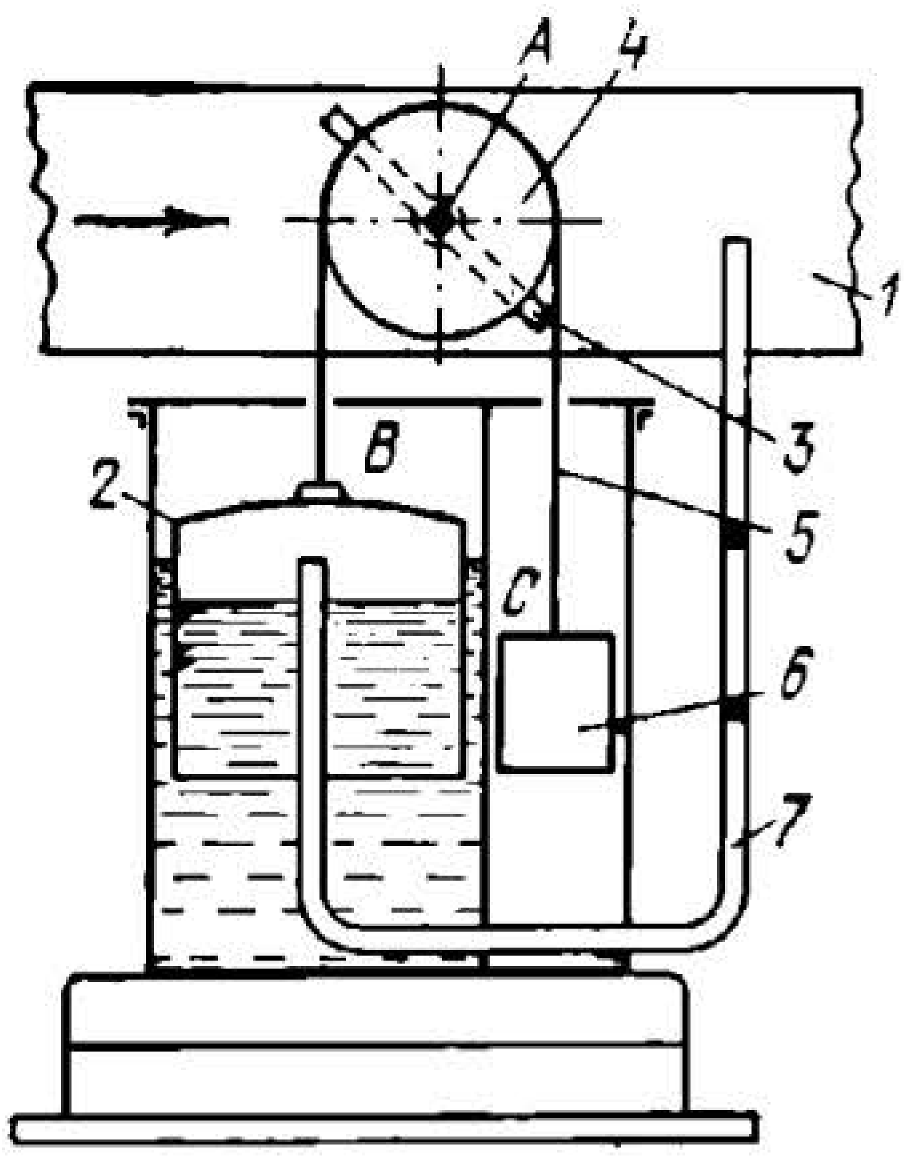
3765	RELAY MECHANISM FOR AXIAL SHIFT OF A TURBINE	SHP Re



The end of the turbine shaft is designed as valve spool *1* which fits into cylinder *2*. Fluid admitted into cylinder *2* passes through holes in the valve spool to safety switch *3*. The piston of the switch is subject to the action of spring *6* and the fluid pressure. Upon axial shift, valve spool *1* moves to the right and opens drain ports *a*. At this, the pressure of the fluid drops and spring *6* actuates the safety switch to stop the turbine. Spindle *4* and hand *5* serve to indicate axial shift of the turbine rotor. To check the position of the rotor, spindle *4* is pushed to the left until it contacts the central extension of the shaft. Then hand *5* indicates the axial position of the rotor on the scale.

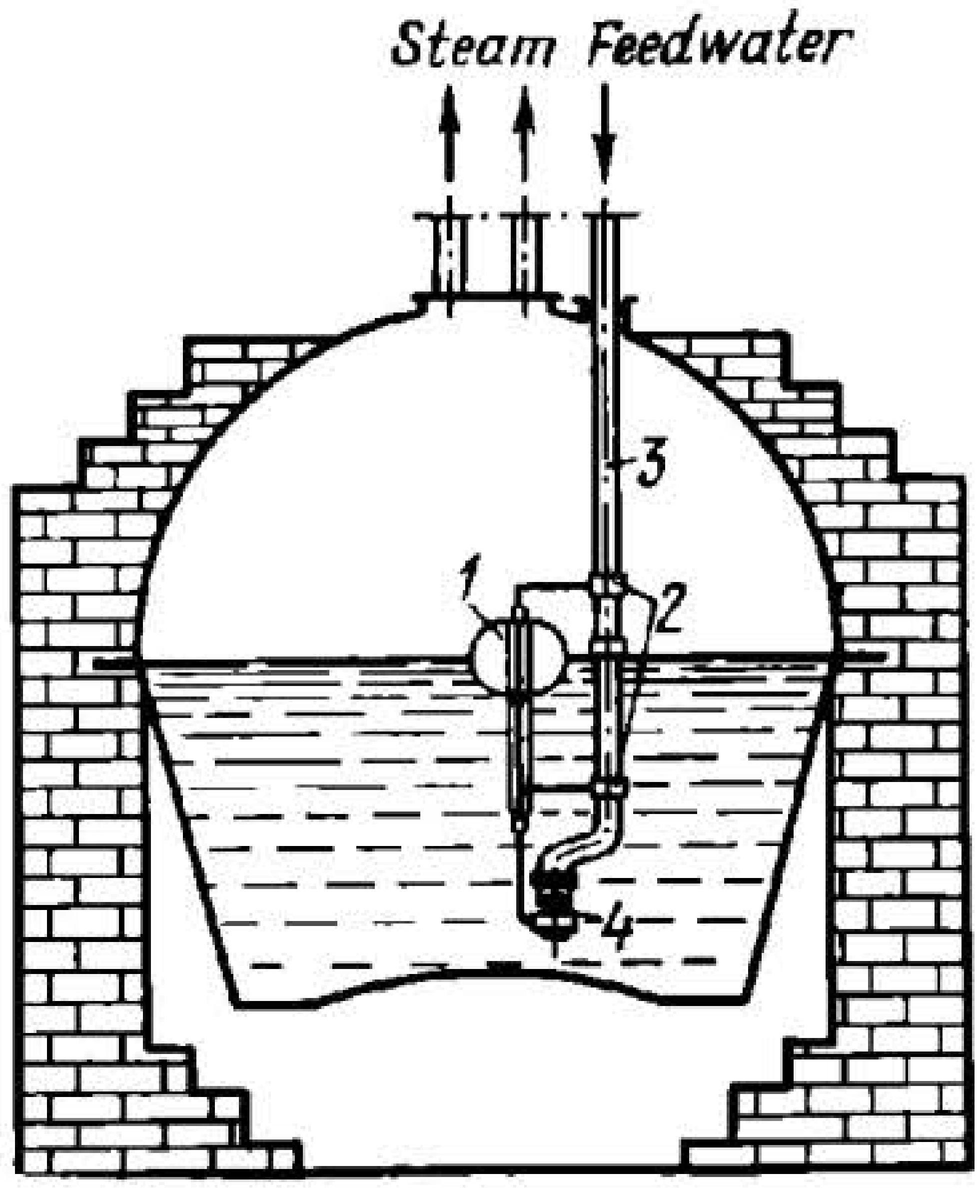
3766	DIRECT-ACTION PRESSURE REGULATOR MECHANISM	SHP Rg

Throttle flap valve *3* turns about fixed axis *A*. Rigidly attached to valve *3* is pulley *4* over which flexible cord *5* runs. One end of cord *5* is attached at point *B* to bell member *2* and the other end at point *C* to counterbalancing weight *6*. When the pressure changes in pipeline *1*, connected to the space under bell member *2* by tube *7*, the bell member rises or descends. This turns throttle flap valve *3* and continues until the pressure in the pipeline approaches the preset value again.



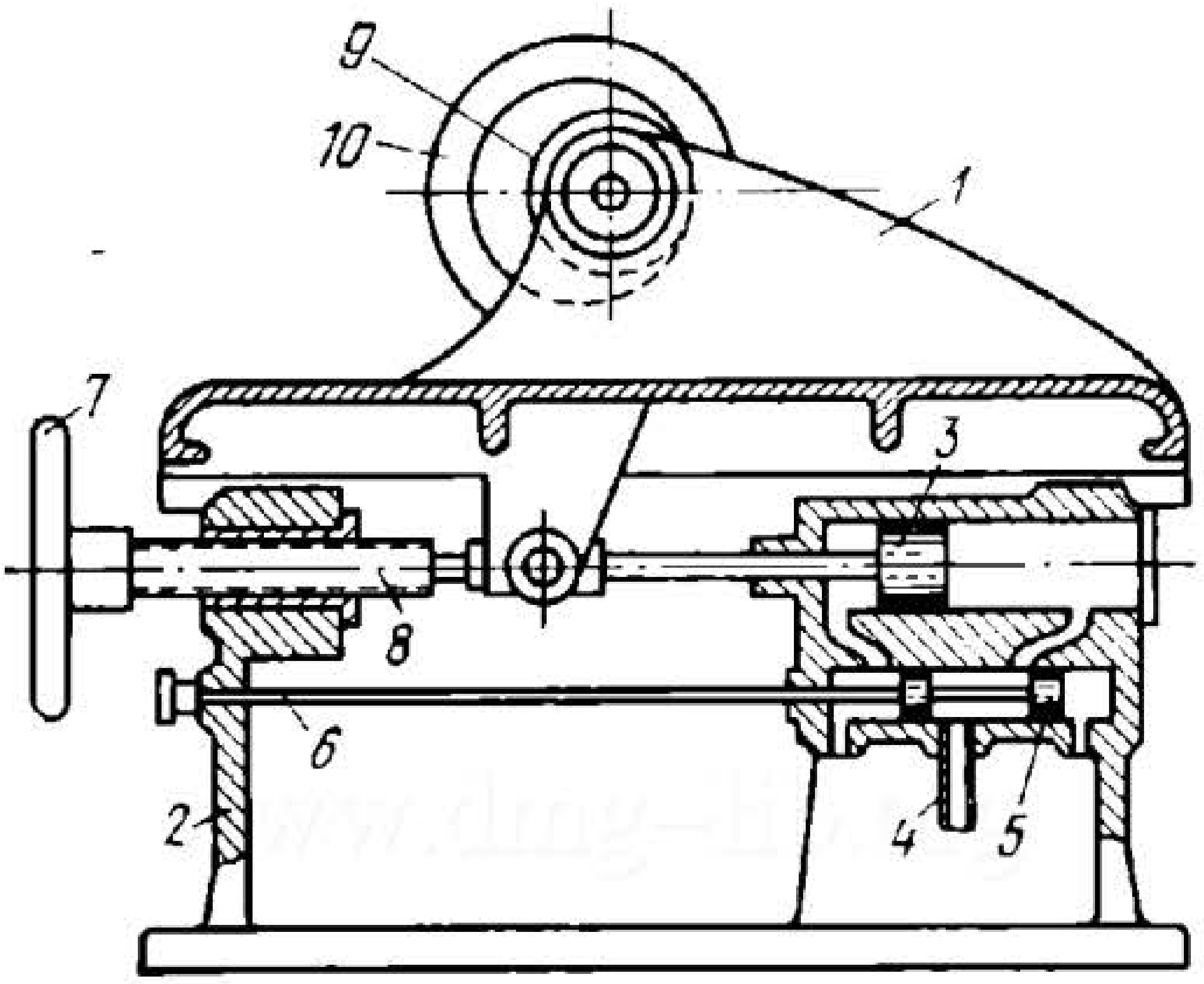
3767	POLZUNOV BOILER WATER LEVEL REGULATOR MECHANISM	SHP Rg

Float *1* is rigidly attached to yokes *2*, which slide along feedpipe *3*, and is linked to valve *4*. When the water level in the boiler is changed by the change in steam consumption, float *1* is raised or lowered. This operates valve *4* which changes the amount of water fed into the boiler.



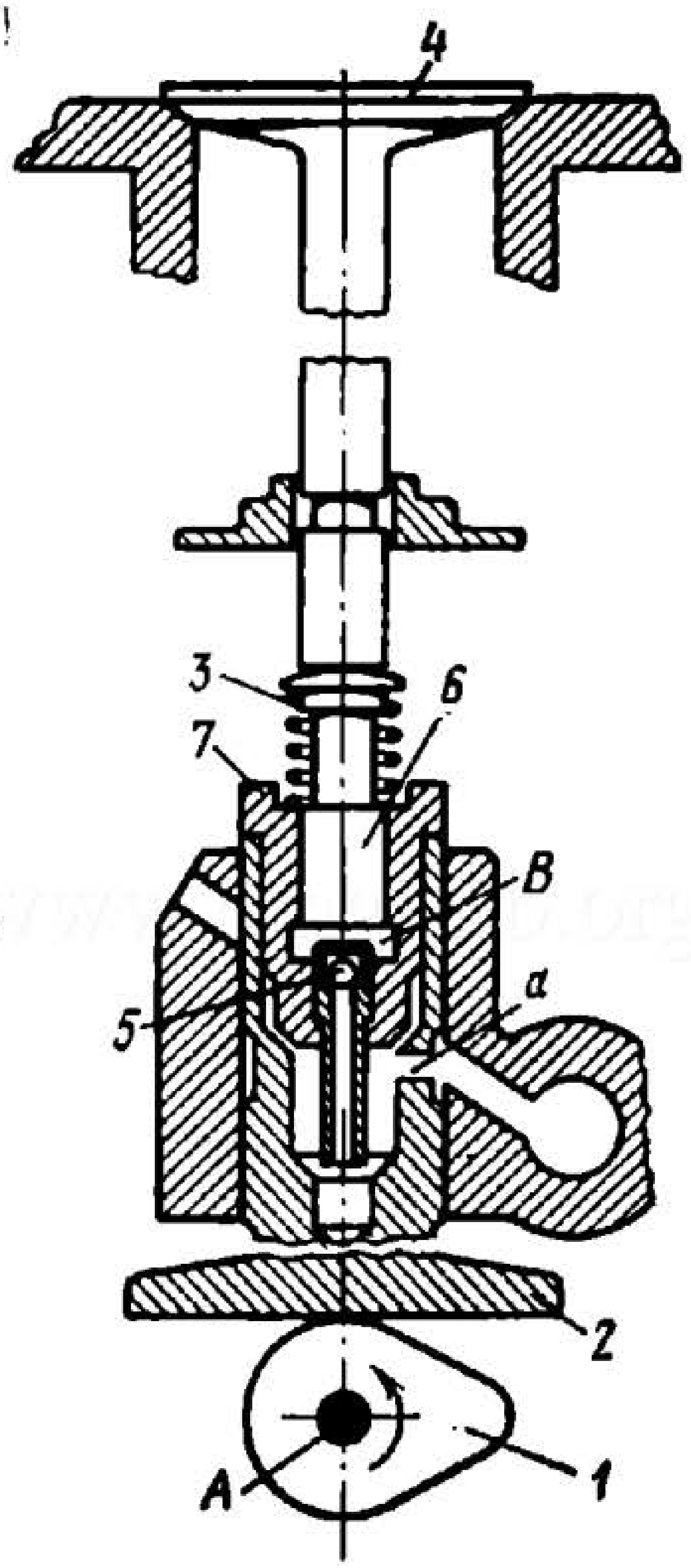
11. MECHANISMS OF OTHER FUNCTIONAL DEVICES (3768 through 3786)

3768	WHEELHEAD BACKLASH ELIMINATION MECHANISM	SHP FD



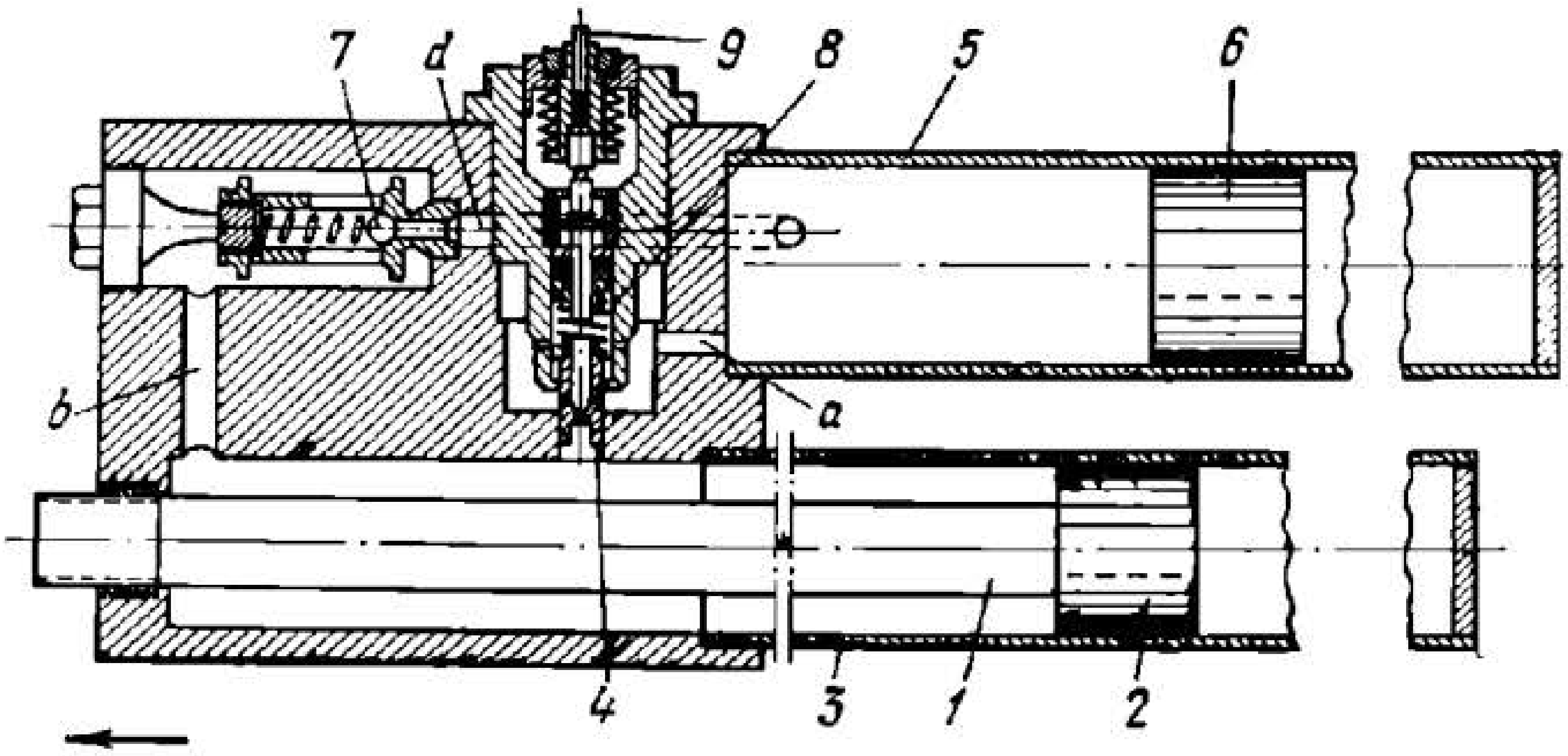
Wheelhead *1* travels along the ways of base *2* and is rigidly attached to piston *3* which is subject to the pressure of fluid in the cylinder. Fluid is admitted to the cylinder through tube *4* and valve spool *5* which is shifted by handle *6*. The fluid flow can be switched over by handle *6* so that grinding wheel *9* is retracted from workpiece *10* (in internal grinding as shown). The wheelhead is set into the required position by handwheel *7* and screw *8*.

3769 HYDRAULIC VALVE LIFTER MECHANISM SHP FD



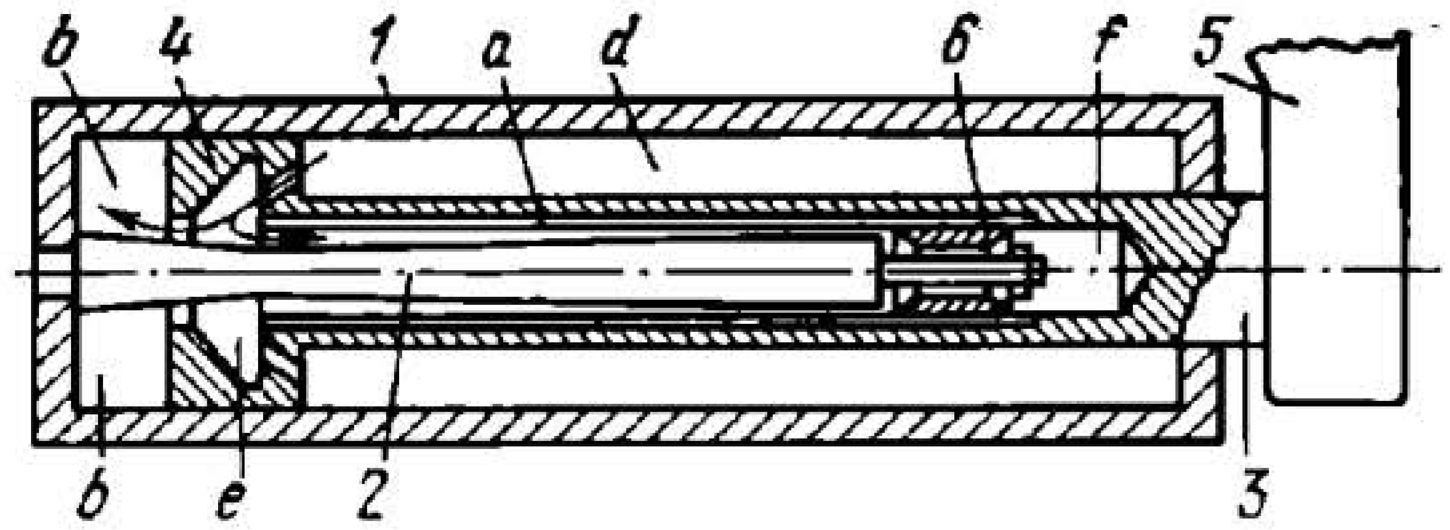
When cam *1* turns counterclockwise about fixed axis *A*, valve lifter *2* is raised, compressing spring *3* and lifting valve *4* off its seat. At this, ball valve *5* is closed by the fluid. The fluid seeps through the clearance between plunger *6* and cylinder *7*. Upon further rotation of cam *1*, valve *4* drops back on its seat. Regulating chamber *B* is filled with fluid through raised ball valve *5*. Fluid is admitted inside the valve lifter through port *a*.

3770	COUNTERRECOIL MECHANISM WITH A VALVE-TYPE RECOIL BRAKE FOR ARTILLERY SYSTEMS	SHP FD



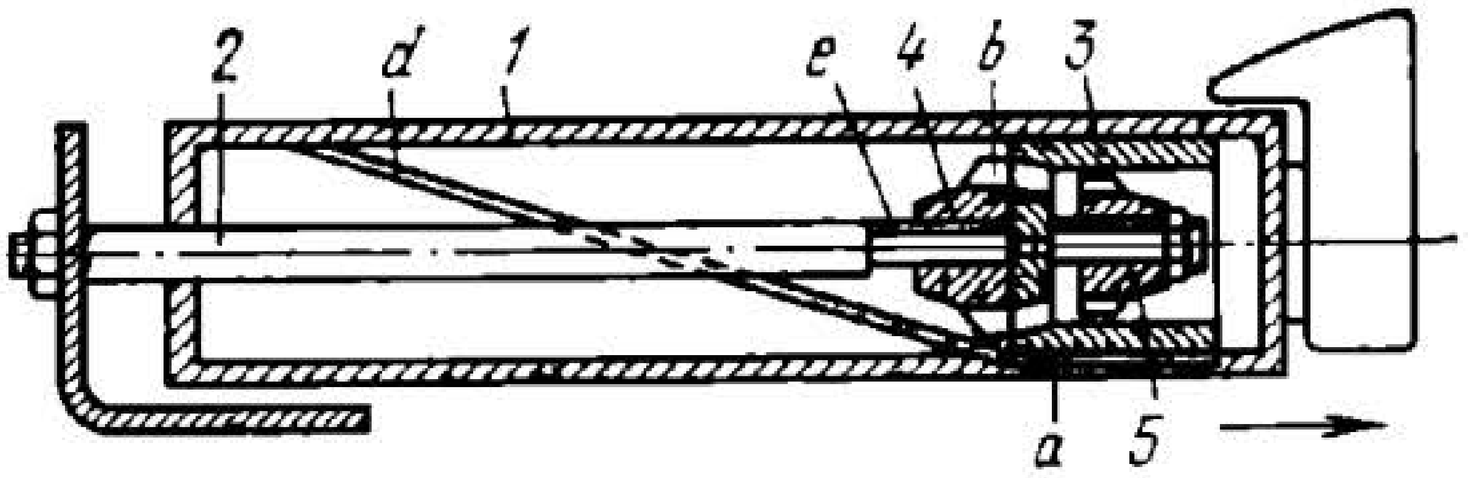
Upon recoil of the barrel, linked by rod *1* to piston *2*, fluid is forced out of cylinder *3* through raised valve *4* and channel *a* into air tank *5*, moving floating piston *6* to the right. Valve *4* is the recoil brake. The size of the orifice through which the fluid escapes is regulated to suit the fluid pressure and the force exerted by spring *8*. Maximum opening of the valve is limited by stem *9*. Upon counterrecoil, air compressed in air tank *5* forces out the fluid through channel *d*, opened ball valve *7* and channel *b* into cylinder *3*. At this, piston *6* moves in the reverse direction. Ball valve *7* is the counterrecoil brake.

3771 HYDRAULIC RECOIL AND COUNTERRECOIL BRAKE MECHANISM FOR ARTILLERY SYSTEMS — SHP FD



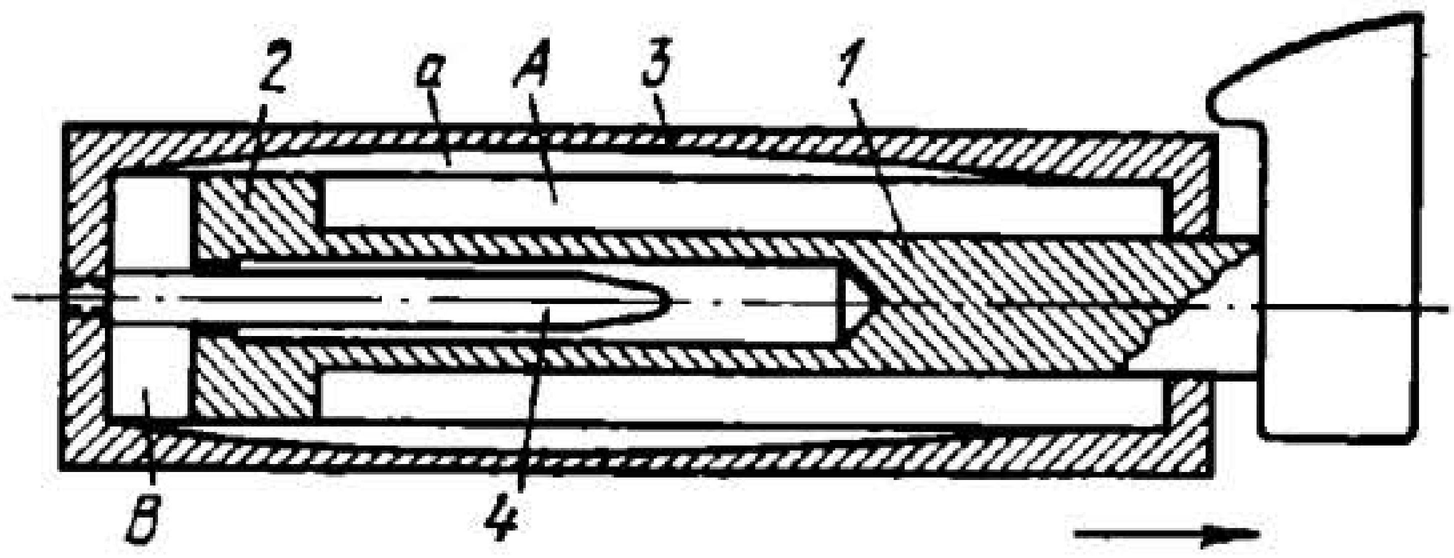
Cylinder *1* of the brake and variable recoil control rod *2* are stationary during recoil and counterrecoil. Rod *3* and piston *4* recoil together with the barrel. At this, fluid from working end *d* of cylinder *1* is forced out into space *e* where it divides into two streams: one flowing into idle end *b* of the brake cylinder and the other pushing back moderator valve *6* and passing into space *f*. Upon counterrecoil, the fluid advances rod *3* onto control rod *2* and moderator valve *6* is pressed against the end face of the control rod, closing the hole of the valve. Fluid from space *f* escapes only through grooves *a* on the inside surface of rod *3* into space *e*. After filling the vacuum, fluid from end *b* is forced into end *d*.

3772 VALVE RECOIL AND COUNTERRECOIL BRAKE MECHANISM FOR ARTILLERY SYSTEMS — SHP FD



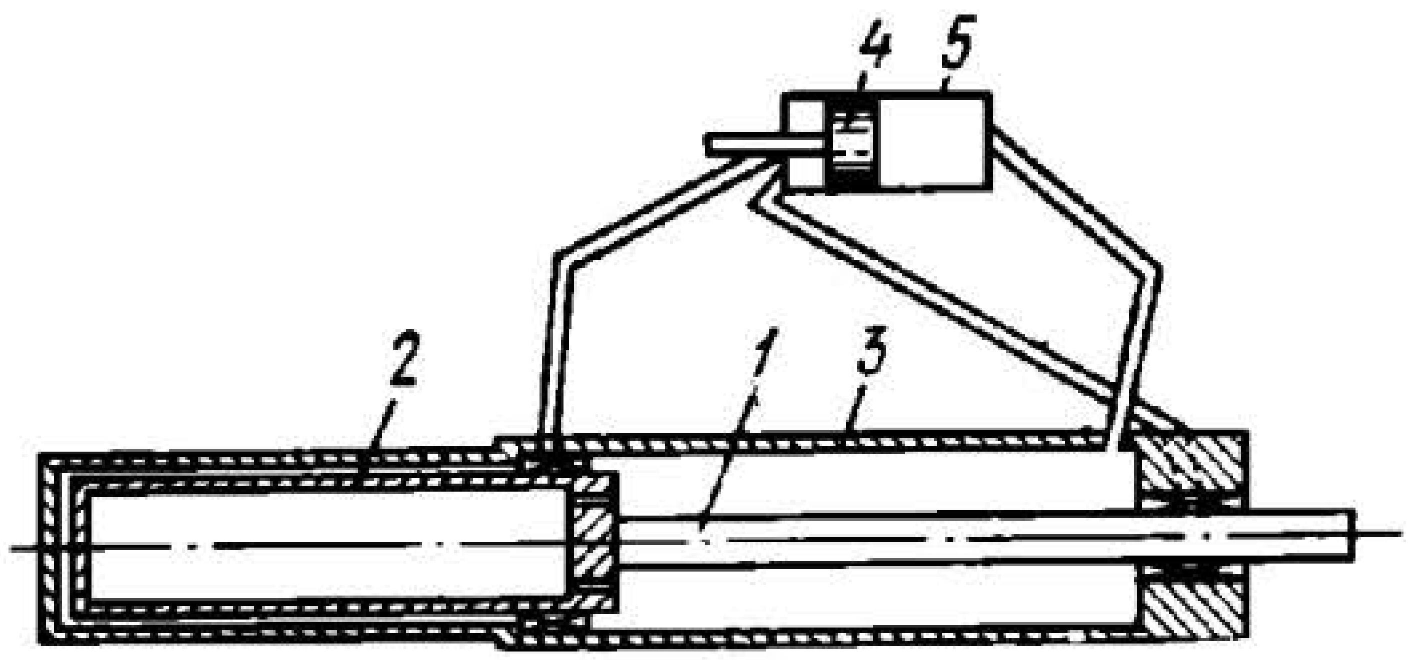
Inside cylinder *1*, attached to the barrel, is stationary rod *2* with piston *3*. Piston *3* has lugs *a* which enter helical slot *d* on the inner surface of cylinder *1*. Piston *3* can rotate with respect to rod *2* but cannot slide along it. Arranged at both ends of piston *3* are valves *4* and *5* with ports (grooves) *b*. The valves, held against rotation by keys *e*, can slide axially a certain distance. Upon recoil to the right, the piston turns on its rod, closing the ports of valve *4*, held against the piston by the pressure of the fluid which is forced out through ports *b* behind the piston, and this brakes the recoil motion. Valve *5* is shifted away from the piston. Upon counterrecoil, the fluid flow is in the opposite direction. Braking begins only after the vacuum is filled, and is carried out by valve *5*.

3773	GROOVE-TYPE RECOIL BRAKE AND NEEDLE-TYPE COUNTERRECOIL BRAKE MECHANISM FOR ARTILLERY SYSTEMS	SHP FD



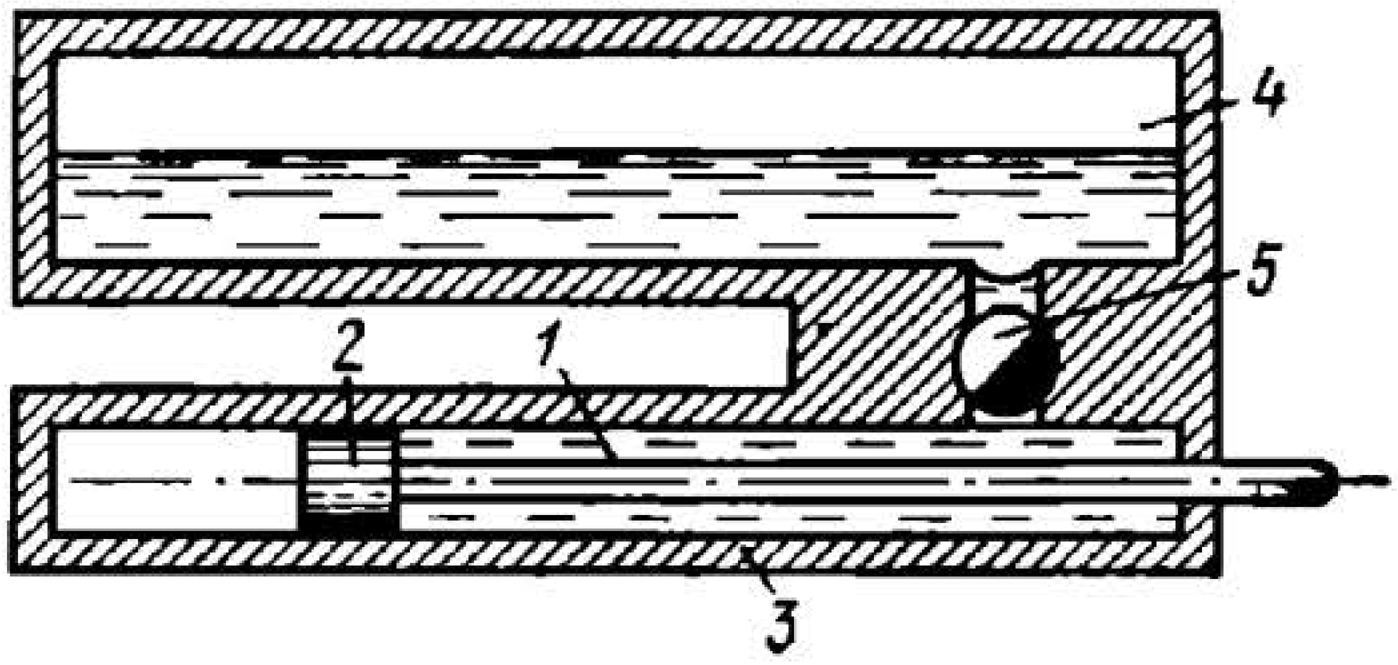
Upon recoil of the barrel and rigidly attached rod *1* and piston *2* to the right, fluid from working end *A* flows through groove *a* on the inner surface of cylinder *3* into idle end *B*. This brakes the recoil. At this, a vacuum is set up in end *B* because the volume freed by the piston in end *B* is greater than the volume of fluid forced out of end *A*. During counterrecoil, after filling the vacuum, fluid is forced through groove *a* from end *B* to end *A*, braking the counterrecoil. At this, piston *2* advances onto needle member *4*, secured to the cylinder, forcing out the fluid inside the recess of the piston through the clearance. This also brakes counterrecoil.

3774	PNEUMATIC COUNTERRECOIL MECHANISM FOR ARTILLERY SYSTEMS	SHP FD



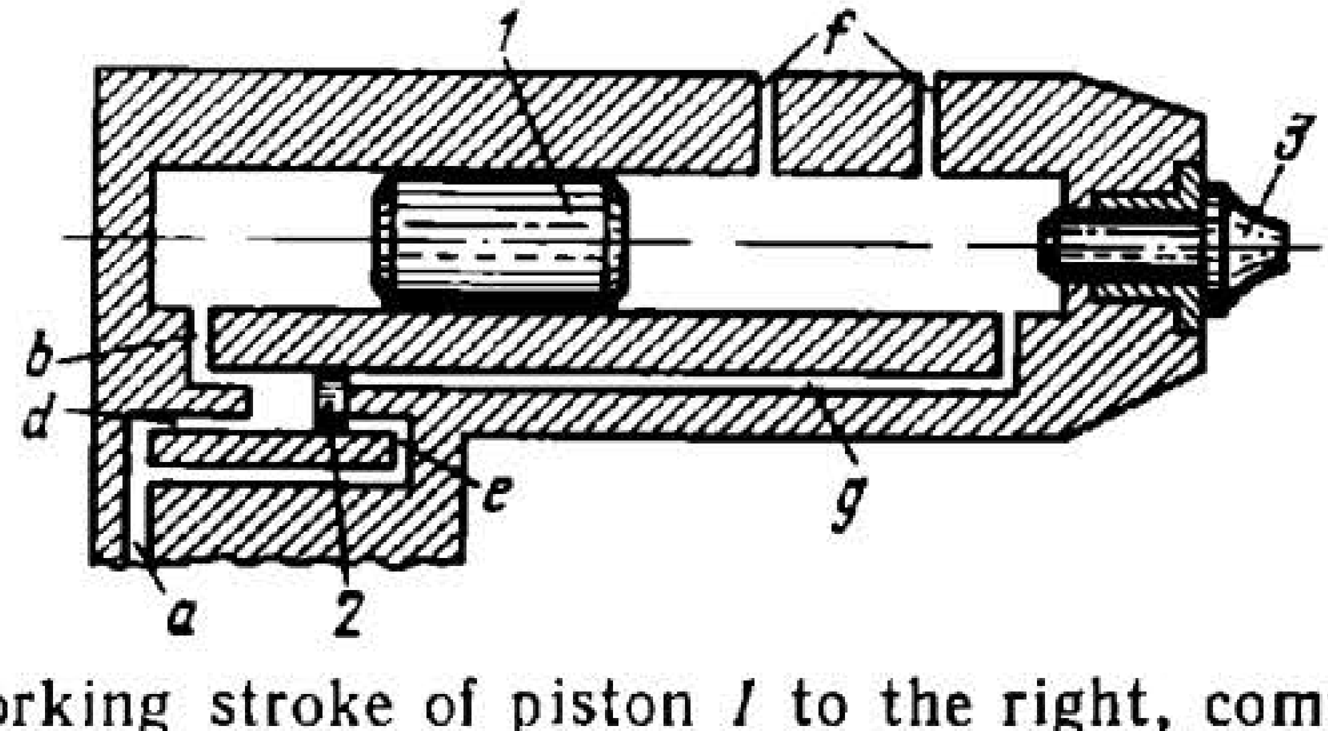
Upon recoil to the right, piston *2*, whose rod *1* is attached to the barrel, compresses the air in cylinder *3*. Upon counterrecoil, the compressed air, acting on the piston, returns the barrel to its initial position. Leakage of air from the cylinder is prevented by delivering fluid to the seals of the counterrecoil mechanism at a pressure somewhat exceeding that of the air compressed in the mechanism. Fluid is delivered from intensifier *5* having piston *4*, with different effective areas on its two ends. Air is at the right end of piston *4* and fluid at the left. The right end of the intensifier cylinder is connected to cylinder *3*.

3775	HYDROPNEUMATIC COUNTERRECOIL MECHANISM FOR ARTILLERY SYSTEMS	SHP FD



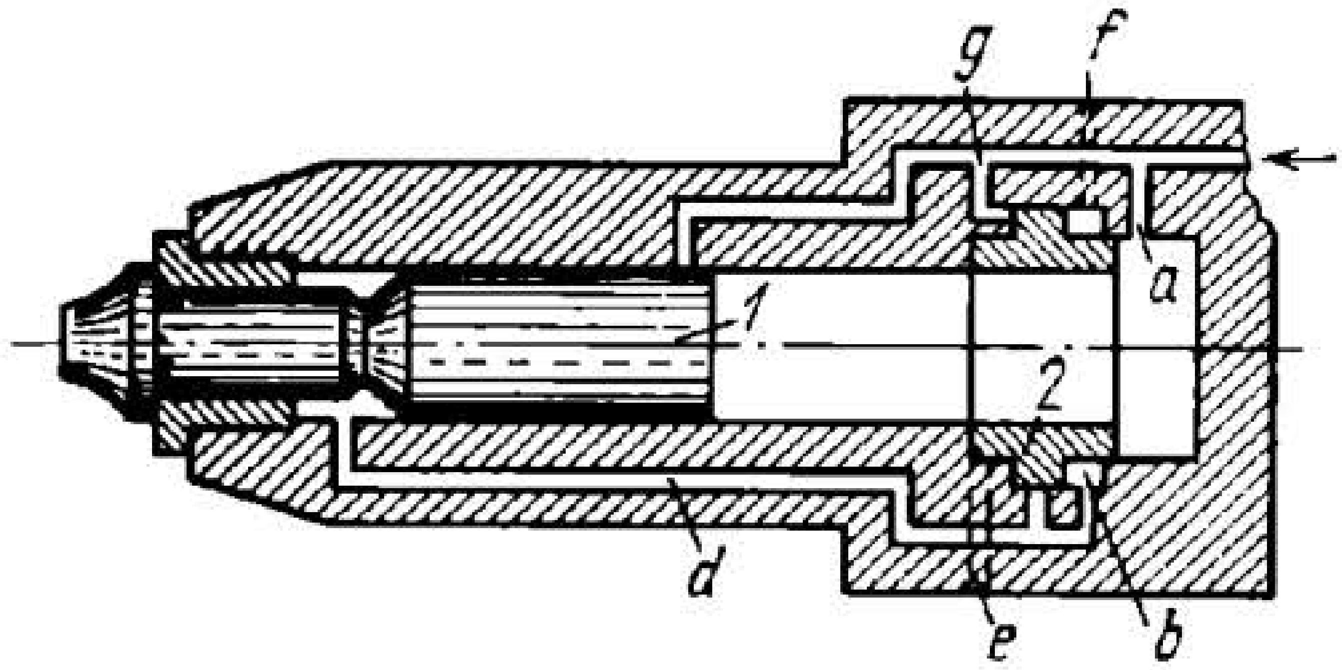
Upon recoil of the barrel, rod *1* with piston *2*, linked to the barrel, moves to the right, forcing fluid from cylinder *3* through throttle valve *5* into tank *4*. As recoil ends, air compressed in tank *4* forces the fluid back into cylinder *3*. At this, piston *2* is moved to the left by the fluid effecting counterrecoil of the barrel. The opening in the throttle can be changed, thereby varying the velocity of motion of the barrel.

3776	AIR HAMMER MECHANISM WITH VALVE-TYPE AIR DISTRIBUTION	SHP FD



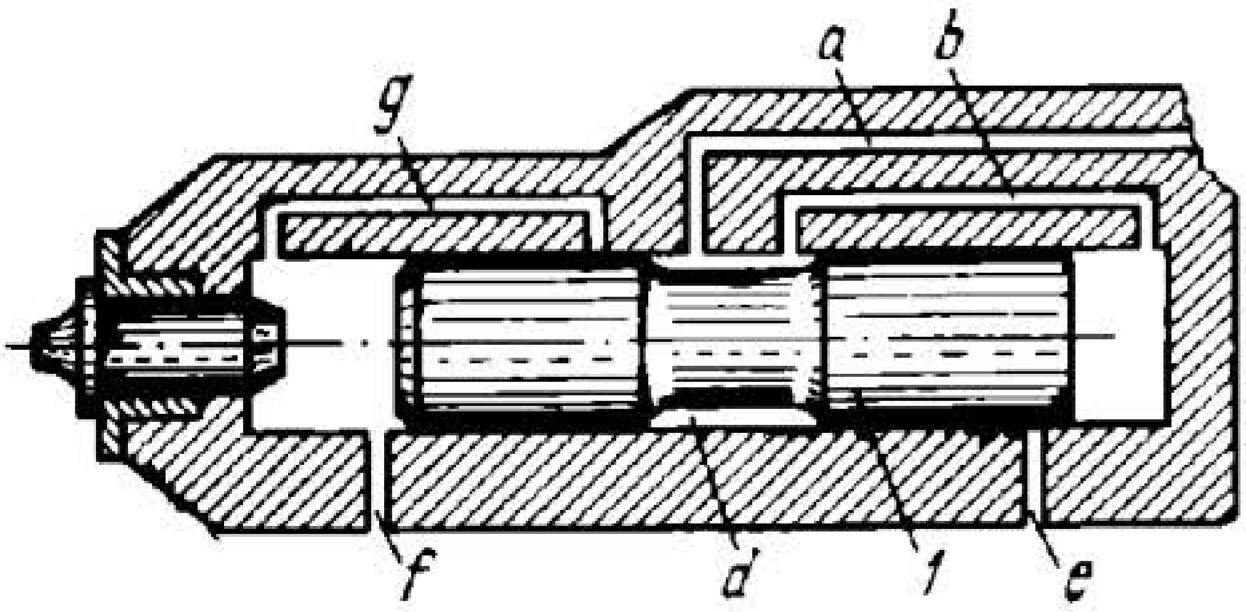
In the working stroke of piston *1* to the right, compressed air is admitted through channels *a*, *d* and *b* to the left end of the cylinder. From the right end of the cylinder, air is forced out through ports *f* to the atmosphere. Near the end of the working stroke, ports *f* are closed by the piston and the remaining air is compressed and passes through channel *g*. This shifts plate valve *2* to the left. At the end of its stroke to the right, piston *1* strikes hammer head *3*. In the return stroke, air passes through channels *a*, *e* and *g* to the right end of the cylinder. At the end of the return stroke, compressed air in the left end of the cylinder shifts valve *2* to its initial position.

3777	AIR HAMMER MECHANISM WITH SLIDE-VALVE AIR DISTRIBUTION	SHP FD



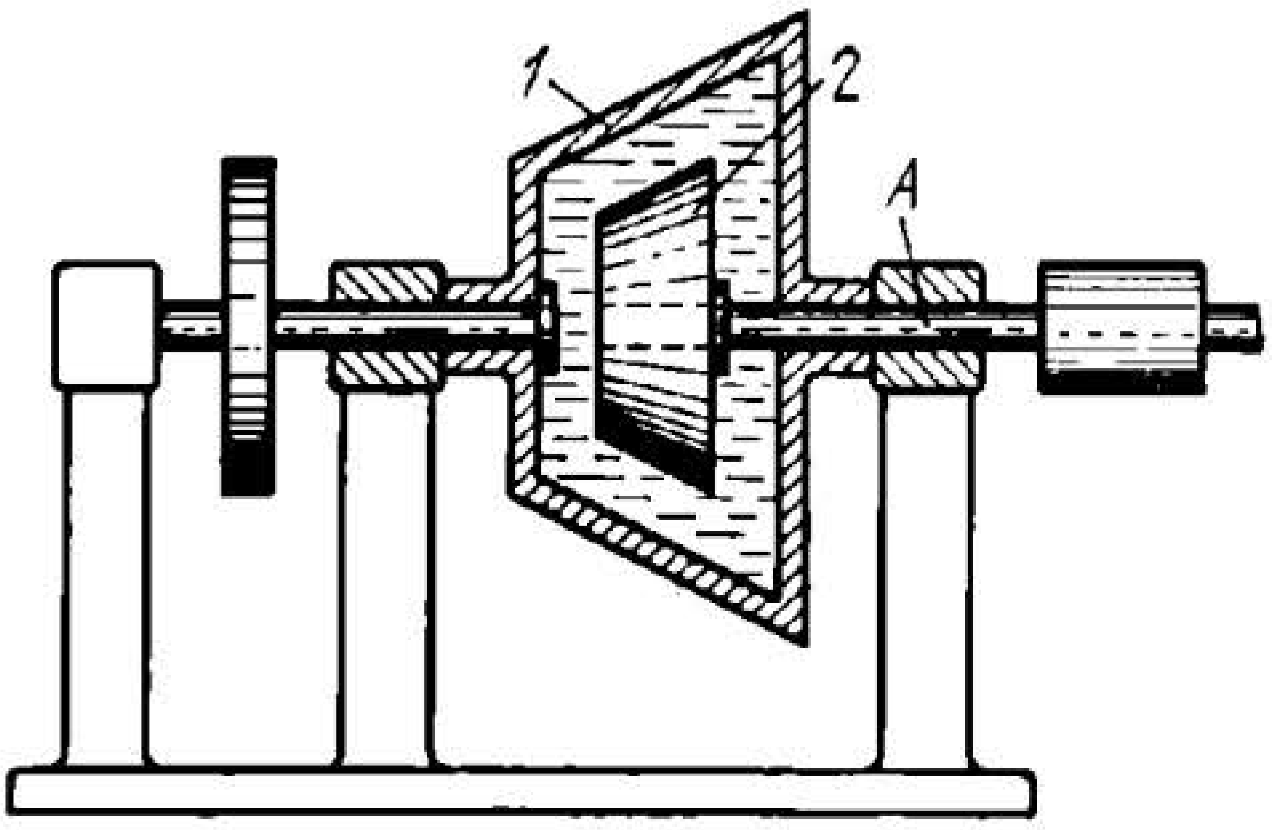
In the working stroke of piston *1*, when it strikes the hammer head, compressed air is admitted through channel *a* to the right end of the cylinder. From the left end, air is forced out through channel *d*, annular groove *b* and port *f* into the atmosphere. At the end of the working stroke, compressed air, passing along channel *g*, shifts slide valve *2* to the right and is admitted through channel *d* to the left end of the cylinder, effecting the return stroke of piston *1*. From the right end, the air is discharged through port *e*. At the end of the return stroke, port *e* is closed by piston *1*, air in the right end of the cylinder is compressed and it shifts slide valve *2* to the left. This begins the working stroke again.

3778	AIR HAMMER MECHANISM WITH PISTON AIR DISTRIBUTION	SHP FD



Compressed air, admitted through channel *a*, annular groove *d* of the piston and channel *b*, moves piston *1* to the left. Air from the left end of the cylinder is discharged to the atmosphere through port *f*. At the end of its working stroke, piston *1* closes channel *b* and discharge port *f*, and opens channel *g* and discharge port *e*. Then compressed air is admitted through channel *a*, annular groove *d* and channel *g*, effecting the return stroke of piston *1*.

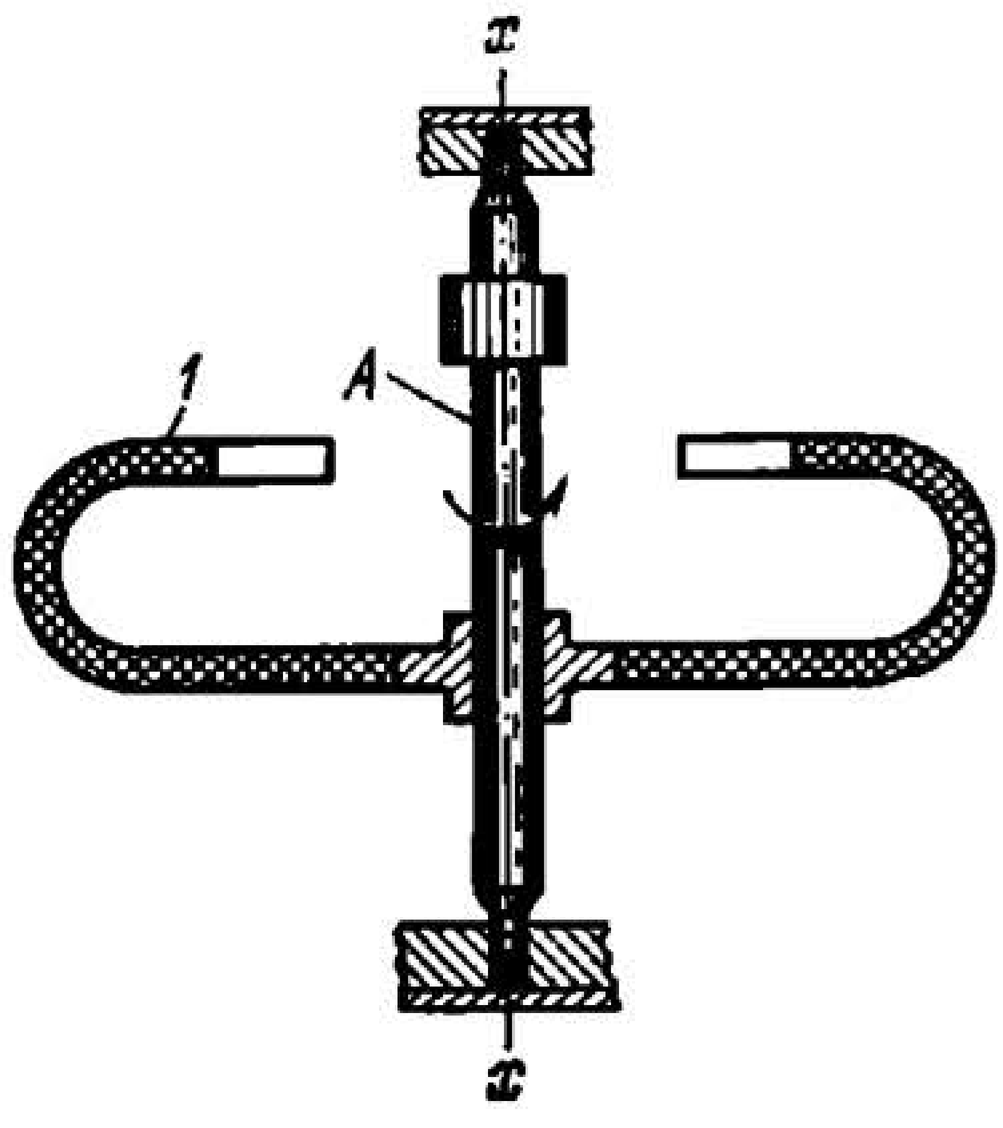
3779	HYDRAULIC ANGULAR VELOCITY EQUALIZER MECHANISM	SHP FD

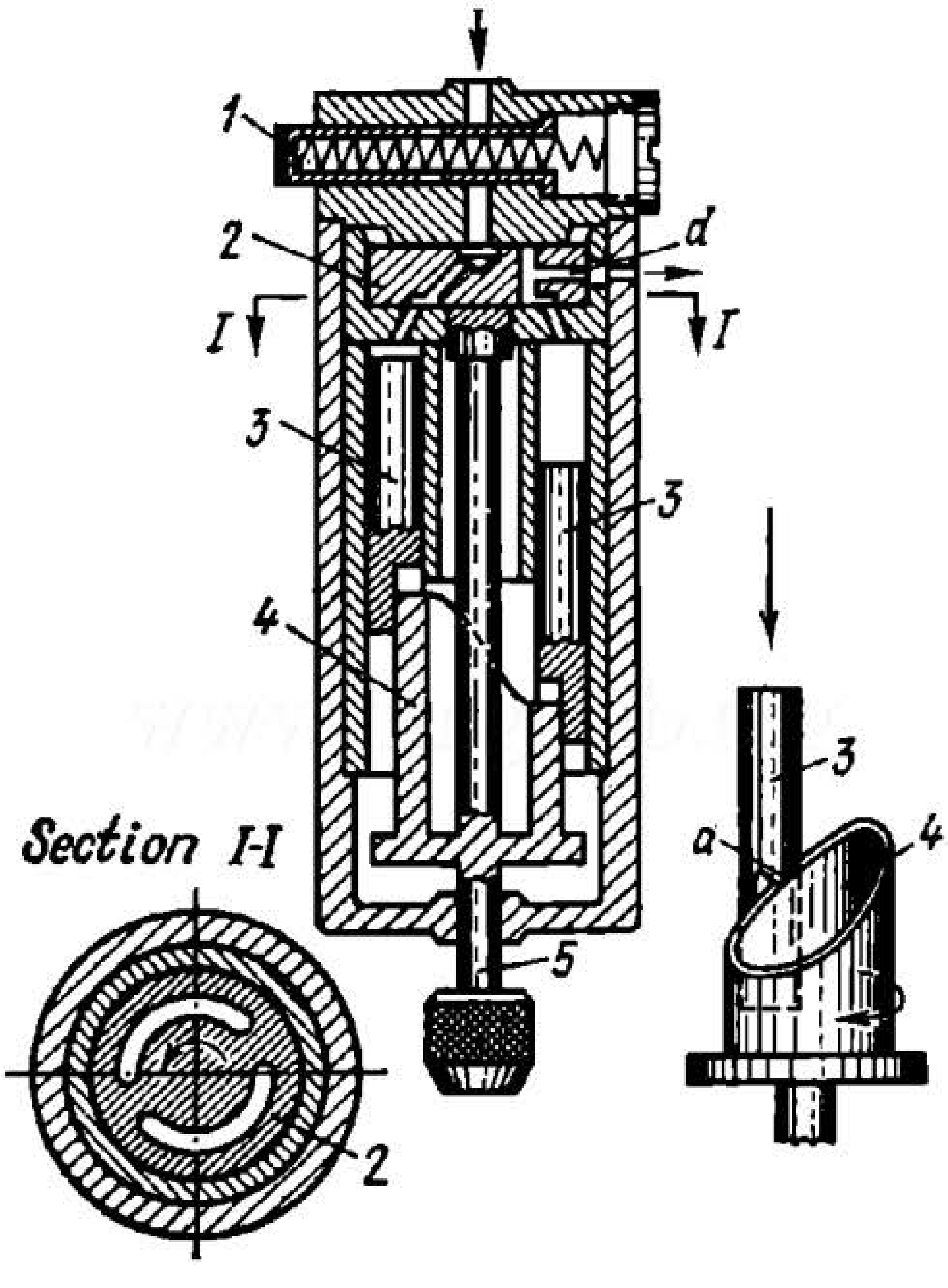


Torque is transmitted to rotor *2*, mounted on shaft *A*, by means of friction forces between the rotor and a viscous liquid which is rotated by housing *1*. The transmission of motion by a viscous medium provides for more uniform rotation of driven shaft *A*.

3780	HYDRAULIC ANGULAR VELOCITY EQUALIZER MECHANISM	SHP FD

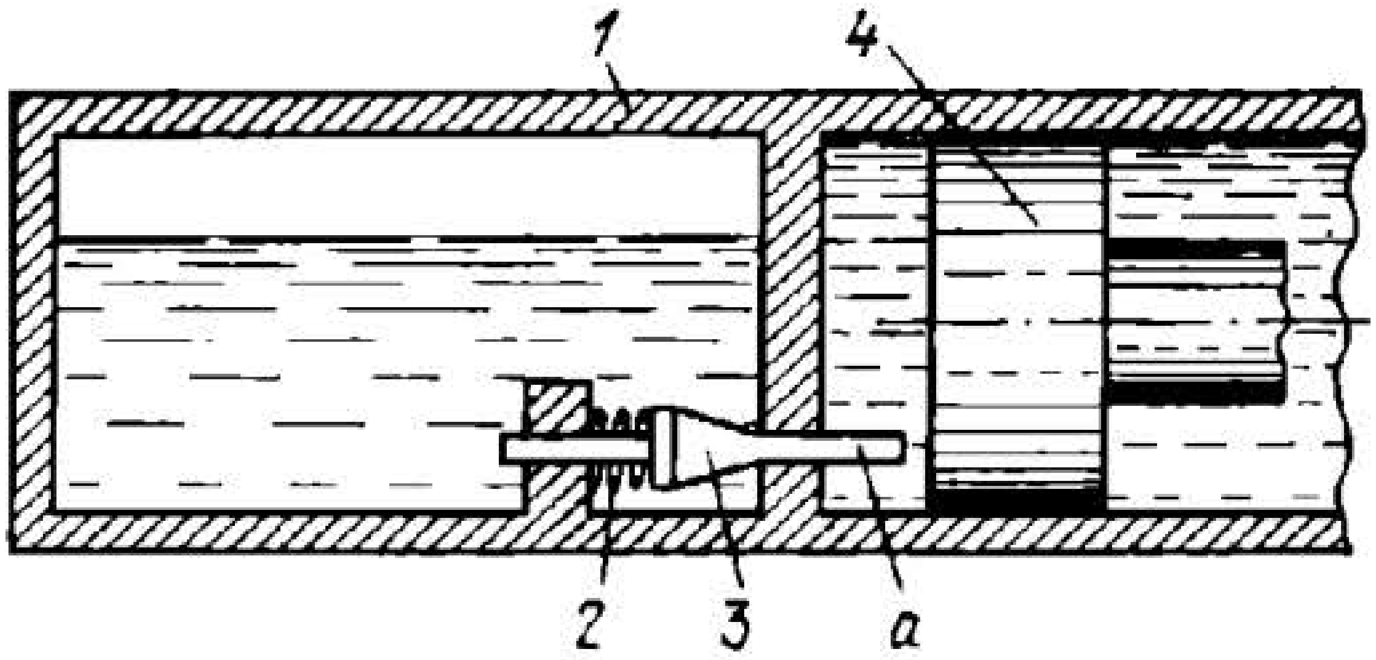
Upon rotation of tube *1*, rigidly mounted on shaft *A* and partly filled with mercury, the centre of gravity of the mercury moves away from axis *x-x* in proportion to the angular velocity of shaft *A*. This increases the moment of inertia of the shaft-tube system. Thus, by varying its own moment of inertia, the system equalizes the angular velocity of the shaft which is subject to periodic disturbing fluctuations.





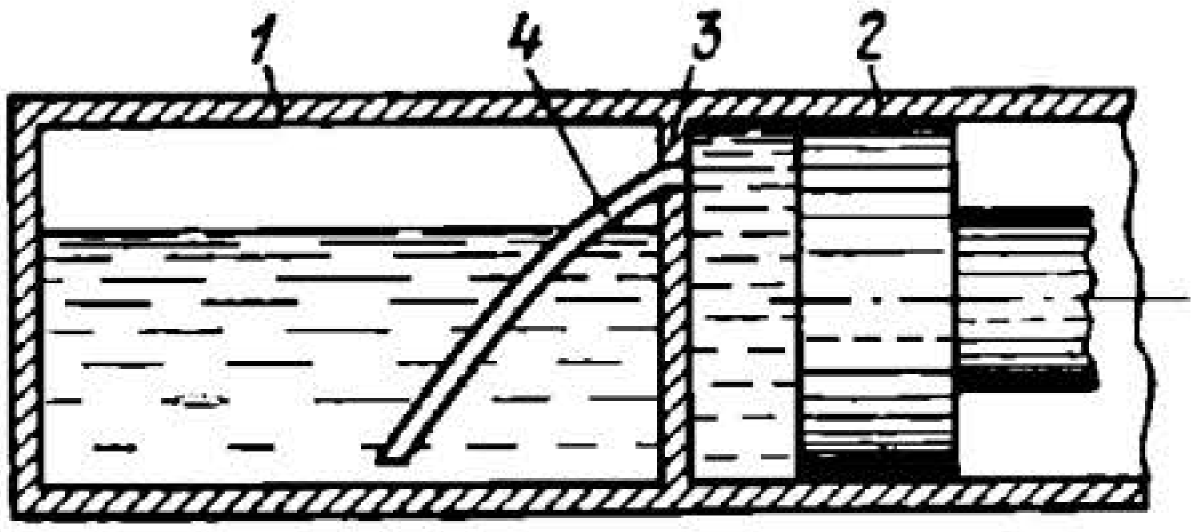
When button *1* is pressed, compressed air, admitted through distributing device *2*, moves axially arranged pistons *3*. Shoulders *a* of pistons *3* engage inclined washer *4* mounted on spindle *5* and rotate the spindle. Exhaust air is released to the atmosphere through port *d*.

3782	HYDROPNEUMATIC FLUID REPLENISHER MECHANISM FOR ARTILLERY SYSTEMS	SHP FD



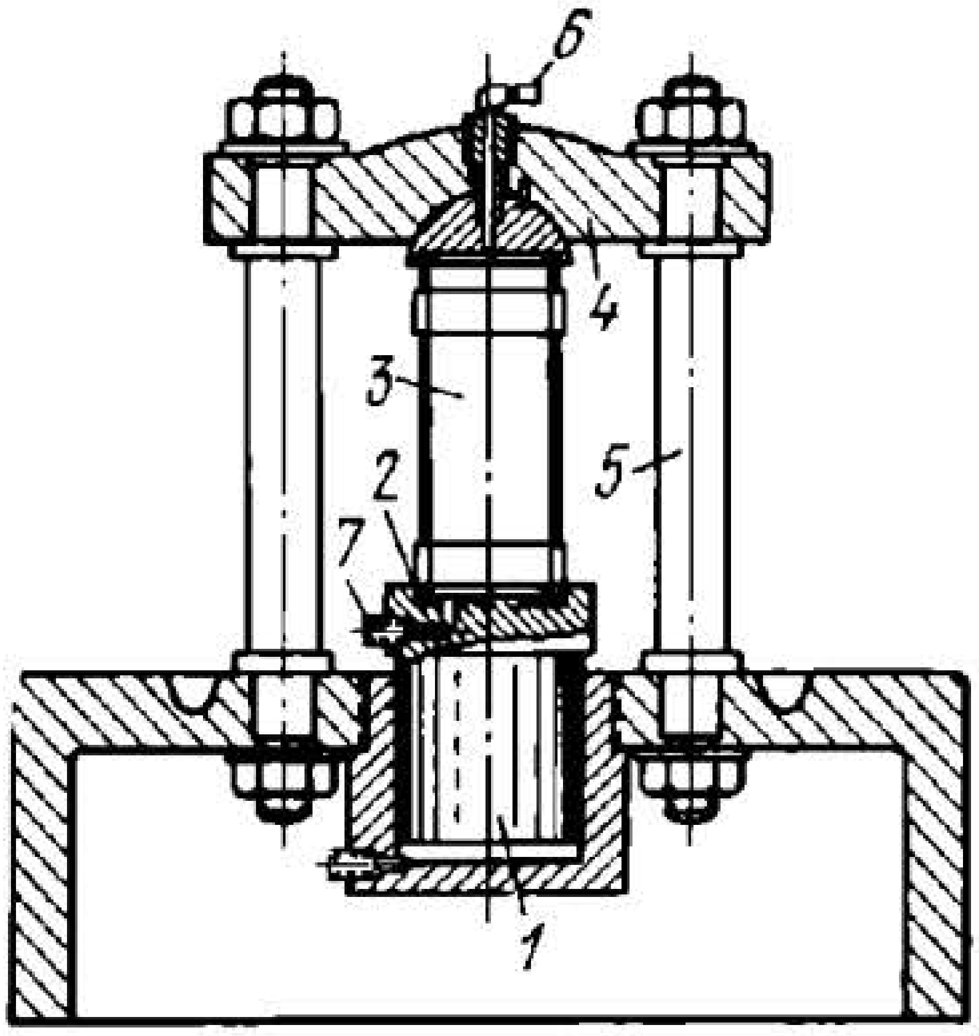
The fluid replenisher consists of tank *1*, connected to the brake cylinder and filled partly with liquid and partly with air. Upon recoil, valve *3*, actuated by spring *2* and compressed air, closes and prevents flow of liquid into the brake cylinder. At the end of the counterrecoil, piston *4* pushes back valve *3* and the surplus volume of liquid, due to its heating during intensive firing, is discharged into the replenisher. As the liquid cools, its volume decreases and liquid is forced out of the replenisher into the braking cylinder.

3783	HYDROPNEUMATIC FLUID REPLENISHER MECHANISM FOR ARTILLERY SYSTEMS	SHP FD



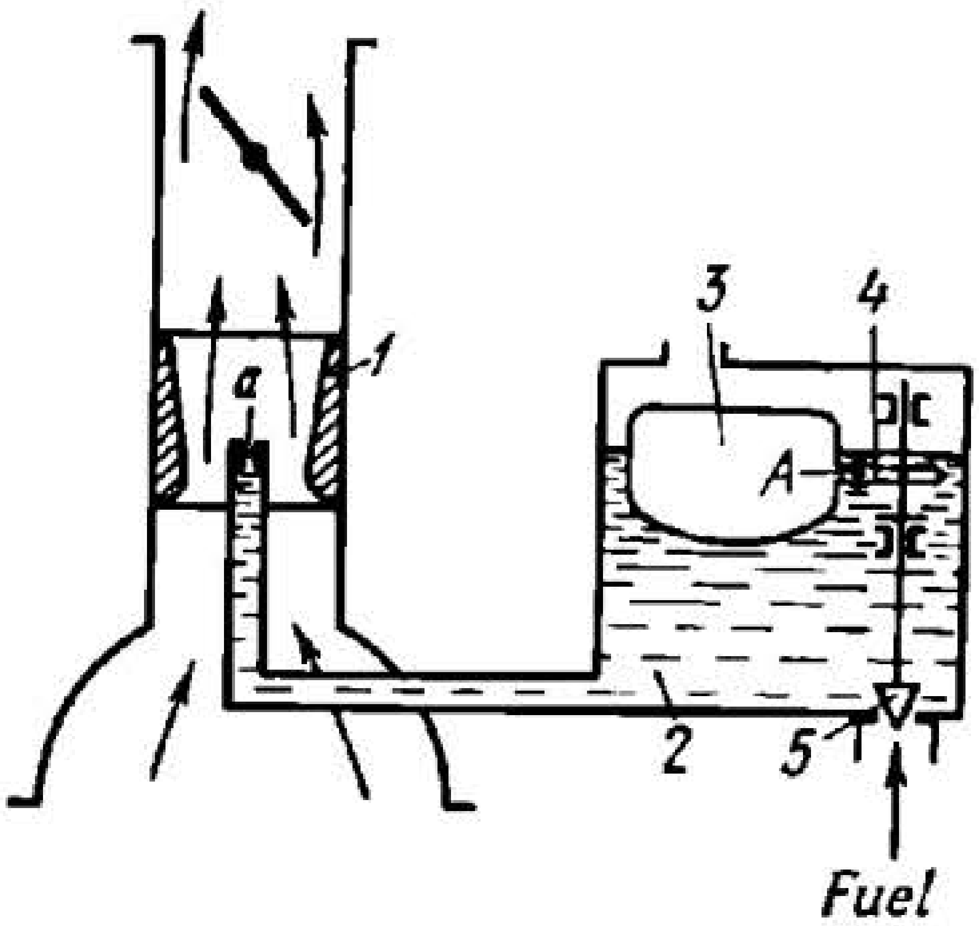
The fluid replenisher is a supplementary tank into which liquid is forced from the brake cylinder when the liquid expands due to its heating during intensive firing. Liquid is returned to the brake cylinder when its volume decreases upon cooling. Replenisher tank *1* is connected by tube *4* to brake cylinder *2*, being separated by partition *3*. The replenisher tank is filled with liquid and air (at a pressure of 1 atm and higher). Upon intensive firing the volume of the air is reduced because surplus liquid passes into tank *1* from cylinder *2* through tube *4*. This raises the pressure of the air. As the liquid cools, it is forced in the required quantity by the air pressure back into cylinder *2*.

3784	HYDRAULIC SHELL CASE TESTING MECHANISM	SHP FD



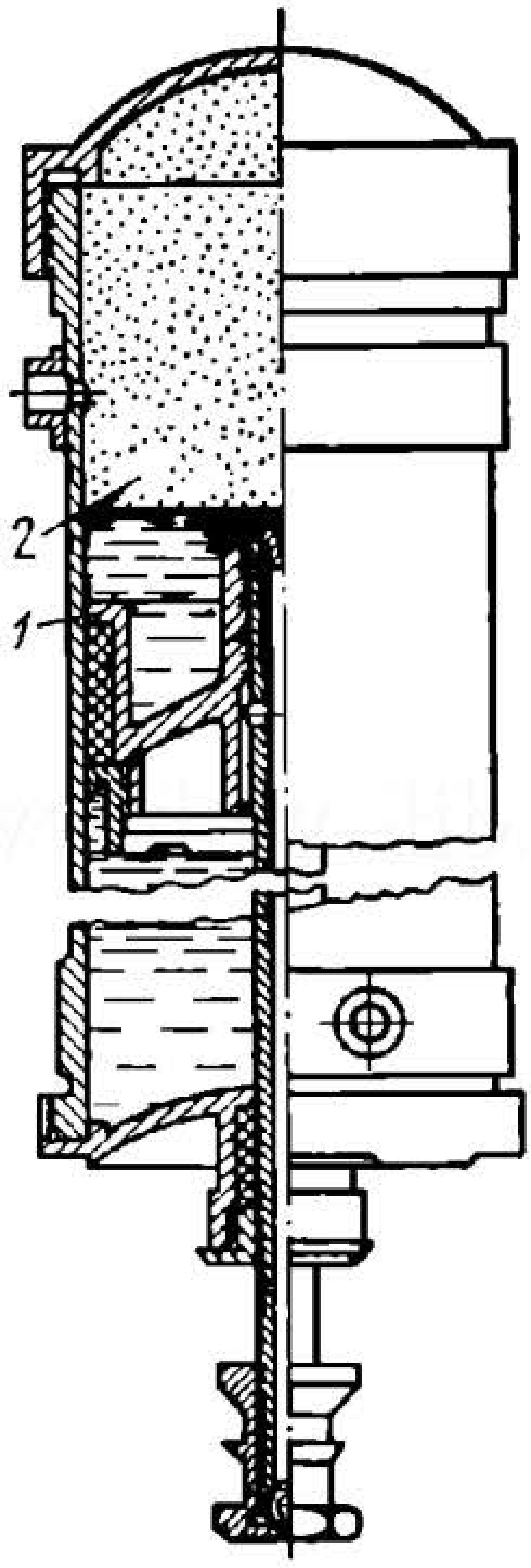
Fluid admitted under piston *1* moves it upward so that it clamps shell case *3* through pad *2* against crosspiece *4* which is secured to the base by two columns *5*. A tube with valve *6* passes through the crosspiece to release air when the shell case is filled with water. When water appears in the valve, it is closed. Water for the test is delivered through tube *7*.

3785	SIMPLE CARBURETTOR MECHANISM	SHP FD



Air supplied to the engine passes through venturi *1*. Owing to the increase in air velocity, the pressure in the venturi drops sharply. At this, fuel from chamber *2* is drawn up through gauged hole *a* in a tube located along the axis of the venturi. By means of float *3*, a constant level of fuel is maintained in chamber *2*. As the level drops, float *3* descends, turning about fixed axis *A*. At this, the other end of lever *4* is raised, opening valve *5* and thereby increasing the amount of fuel supplied to the float chamber. When the level rises, valve *5* is closed, stopping the supply of fuel to the chamber.

3786 | **PNEUMATIC PISTON-TYPE ACCUMULATOR MECHANISM** | SHP FD



As piston *1* is moved upward, air in upper space *2* is compressed, accumulating potential energy. The liquid serves to prevent the air from leaking through from one space to the other (below the piston).

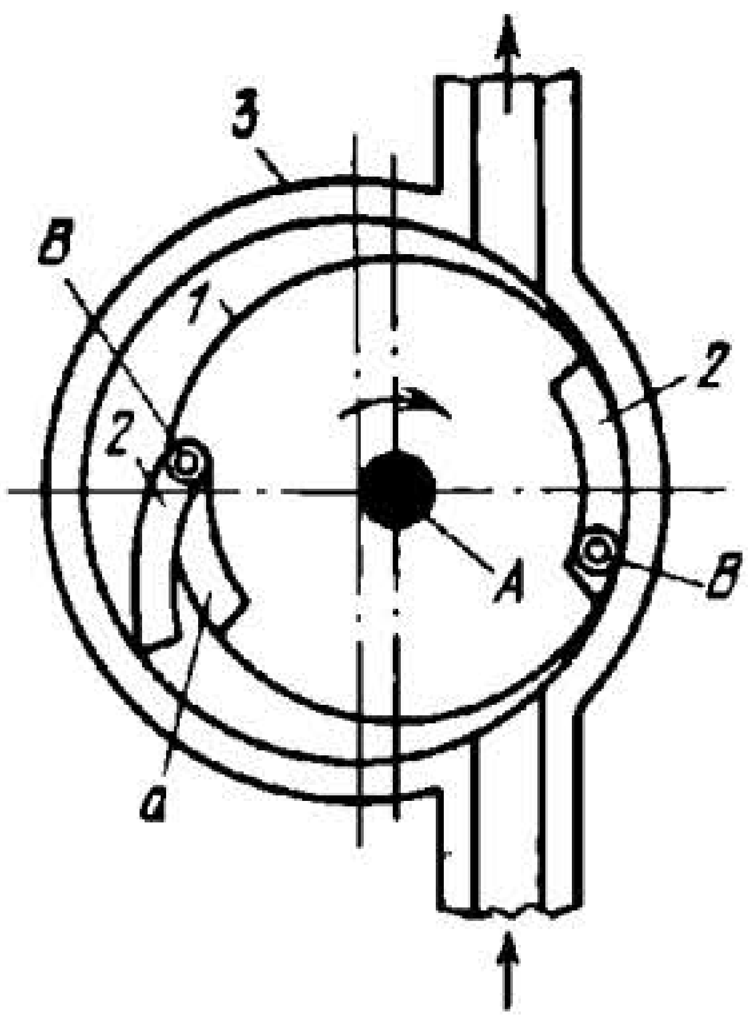
SECTION TWENTY-NINE

Lever-Type Hydraulic and Pneumatic Mechanisms LHP

1. ROTARY VANE AND PISTON PUMP MECHANISMS (3787 through 3850)

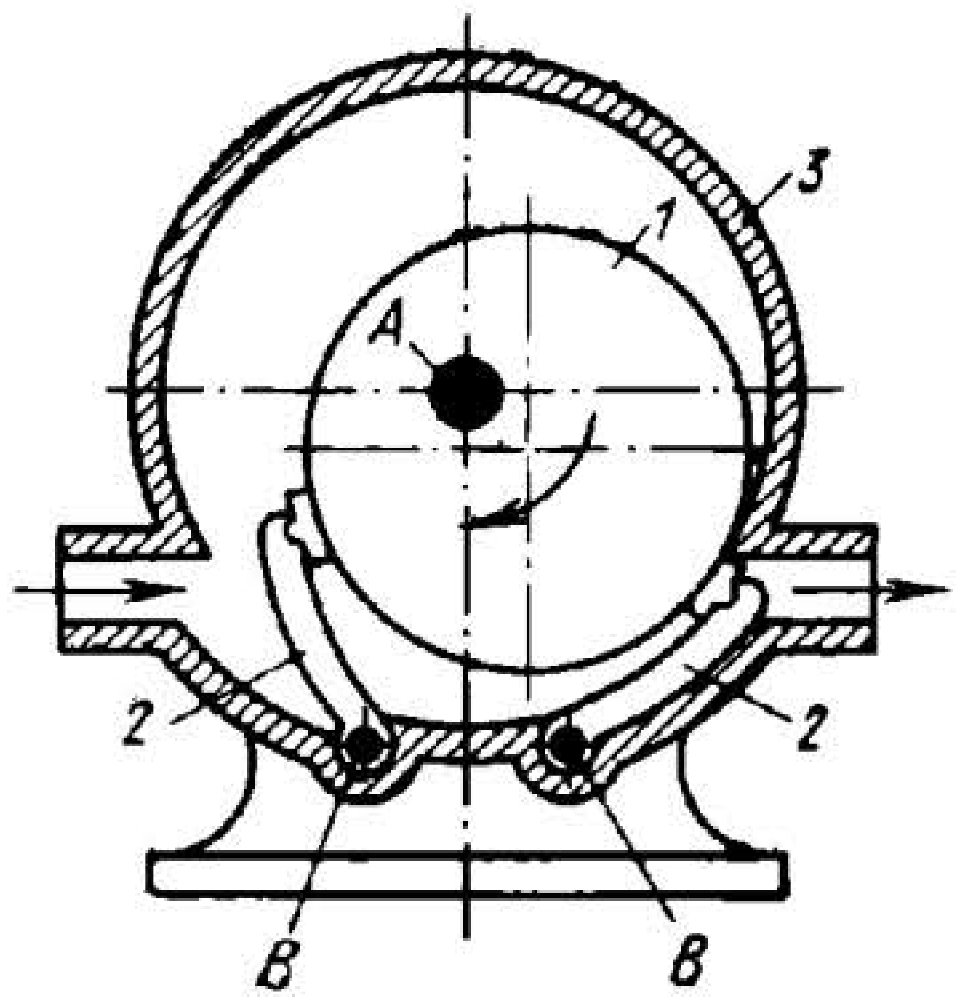
3787	LEVER MECHANISM OF A DOUBLE HINGED-VANE ROTARY PUMP	LHP RP

Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *3*. Vanes *2* turn about axes *B*. When the rotor rotates, vanes *2* are held against the housing by centrifugal force and deliver liquid in the direction of the arrows. Vanes *2* are retracted into slots *a* in rotor *1*.

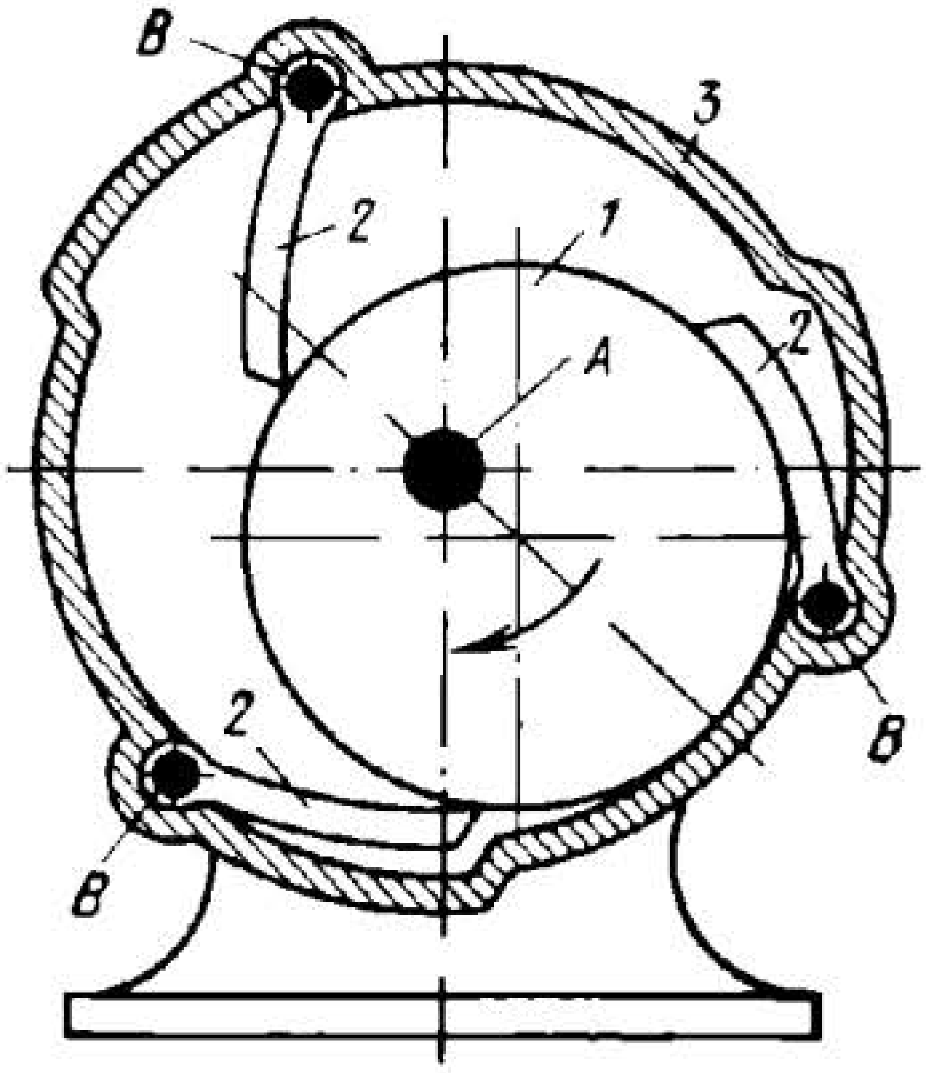


3788	LEVER-ECCENTRIC MECHANISM OF A DOUBLE HINGED-ABUTMENT ROTARY PUMP	LHP RP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *3*. Rotor *1* contacts the internal surface of housing *3*. When rotor *1* rotates, liquid is delivered in the direction of the arrows. The suction and discharge chambers are separated by two hinged abutments *2* which turn about fixed axes *B* and are constantly held against the rotor by springs (not shown).

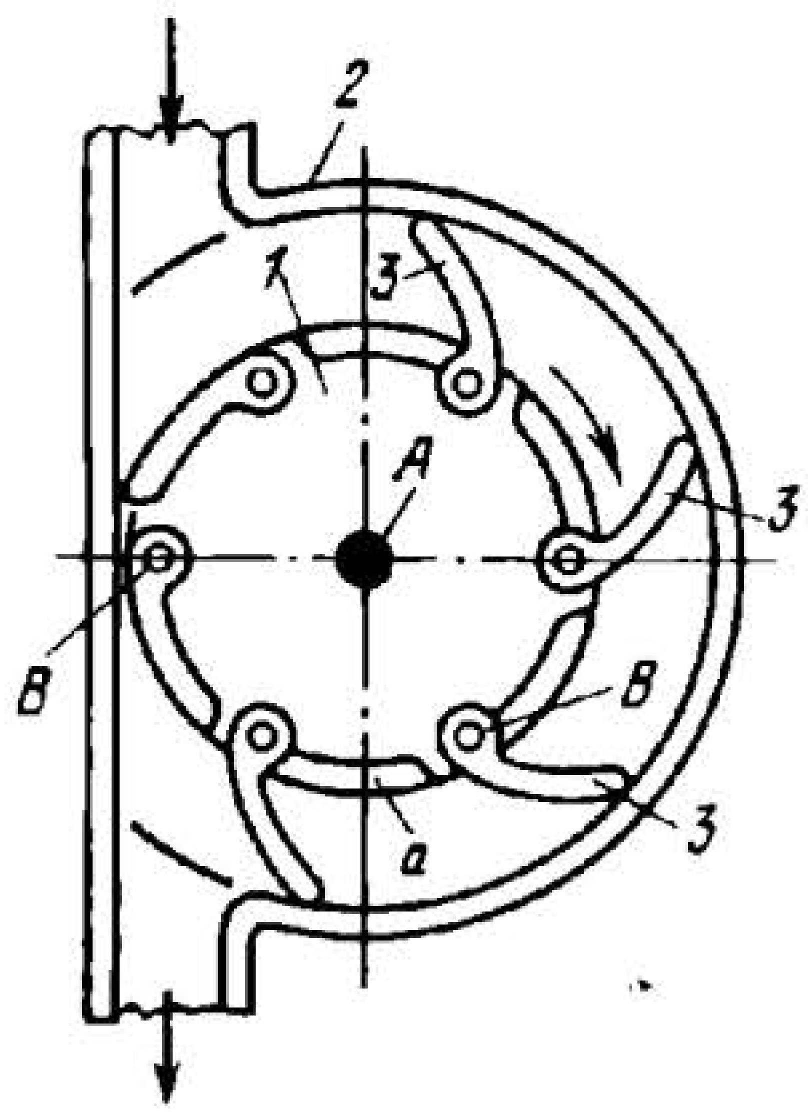


3789	LEVER-ECCENTRIC MECHANISM OF A TRIPLE HINGED-ABUTMENT ROTARY PUMP	LHP RP



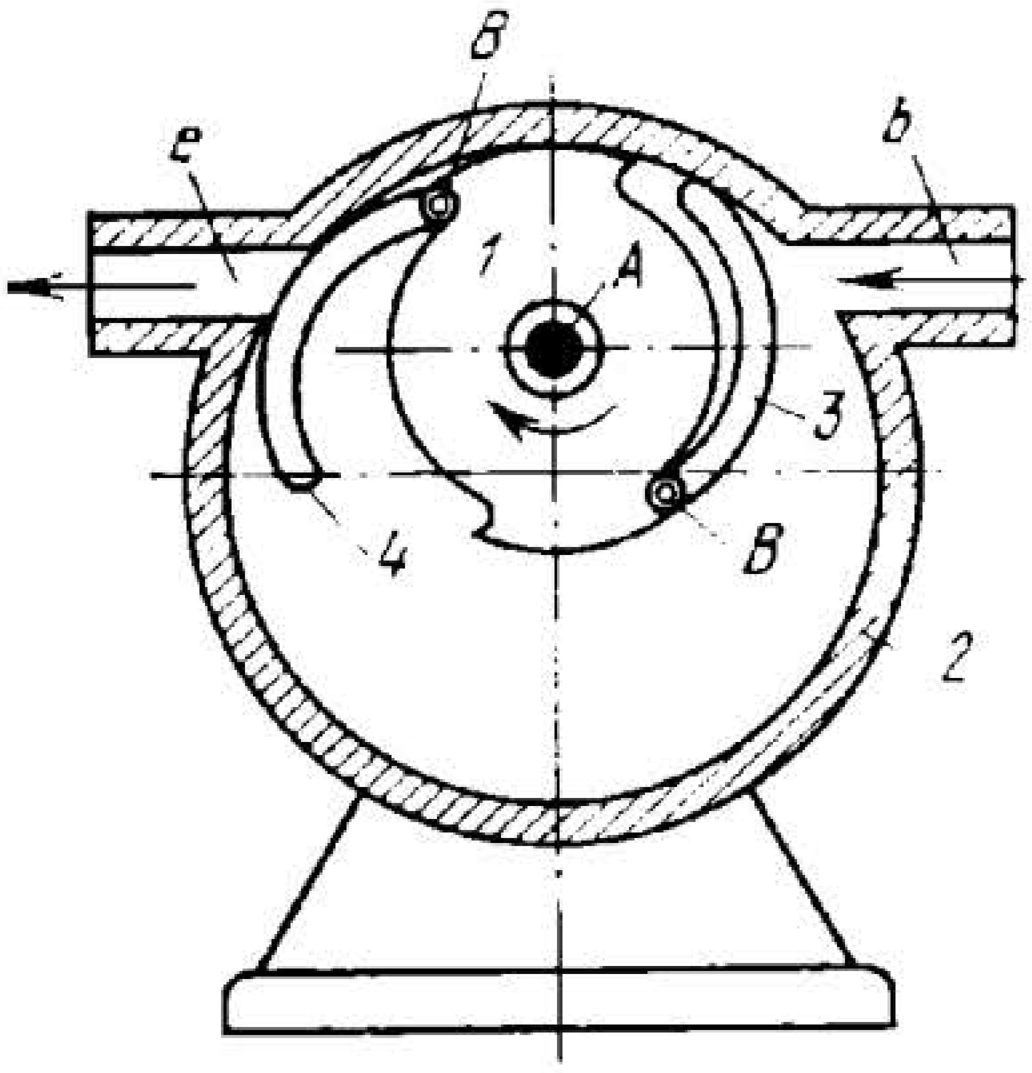
Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *3*. Rotor *1* contacts the internal surface of housing *3*. When rotor *1* rotates, liquid is delivered from the suction to the discharge chambers which are separated by three hinged abutments *2*. The abutments turn about fixed axes *B* and are constantly held against the rotor by springs (not shown).

3790	LEVER MECHANISM OF A SIX HINGED-VANE ROTARY PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, coinciding with the geometric axis of housing *2*. Vanes *3* turn about axes *B*. When the rotor rotates, vanes *3* are held against the housing by centrifugal force or springs (not shown) and deliver liquid in the direction of the arrows. Vanes *3* are retracted into slots *a* in rotor *1*.

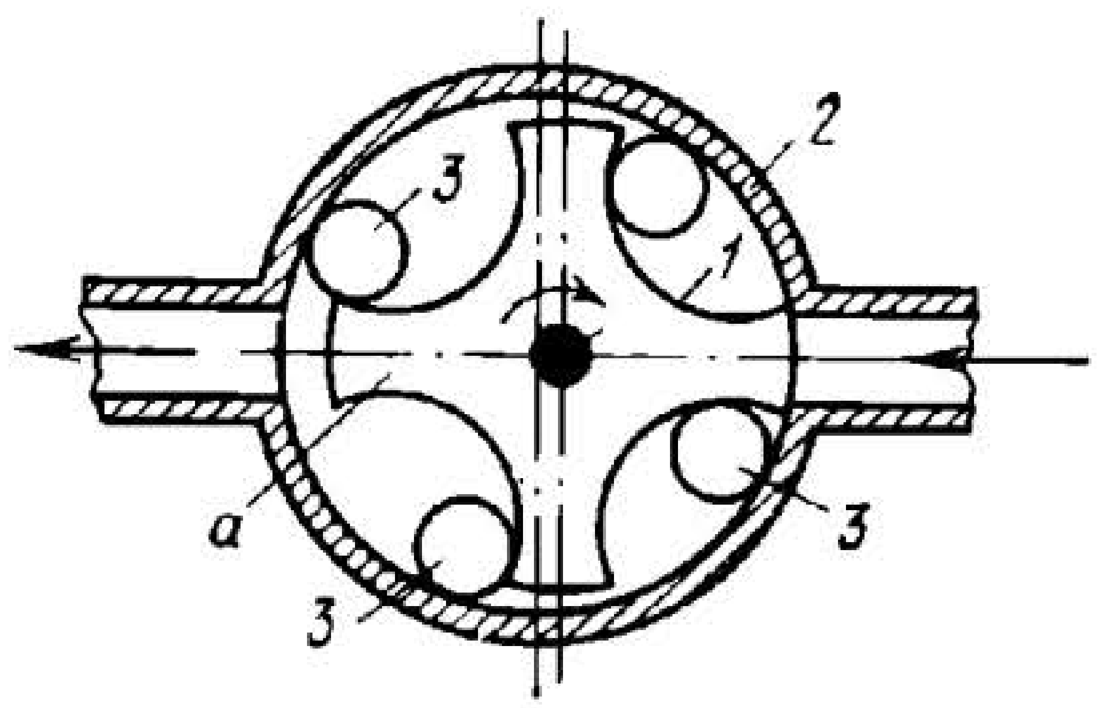
3791	LEVER MECHANISM OF A HINGED-VANE ROTARY PUMP WITH LARGE ANGLE OF VANE SWING	LHP RP



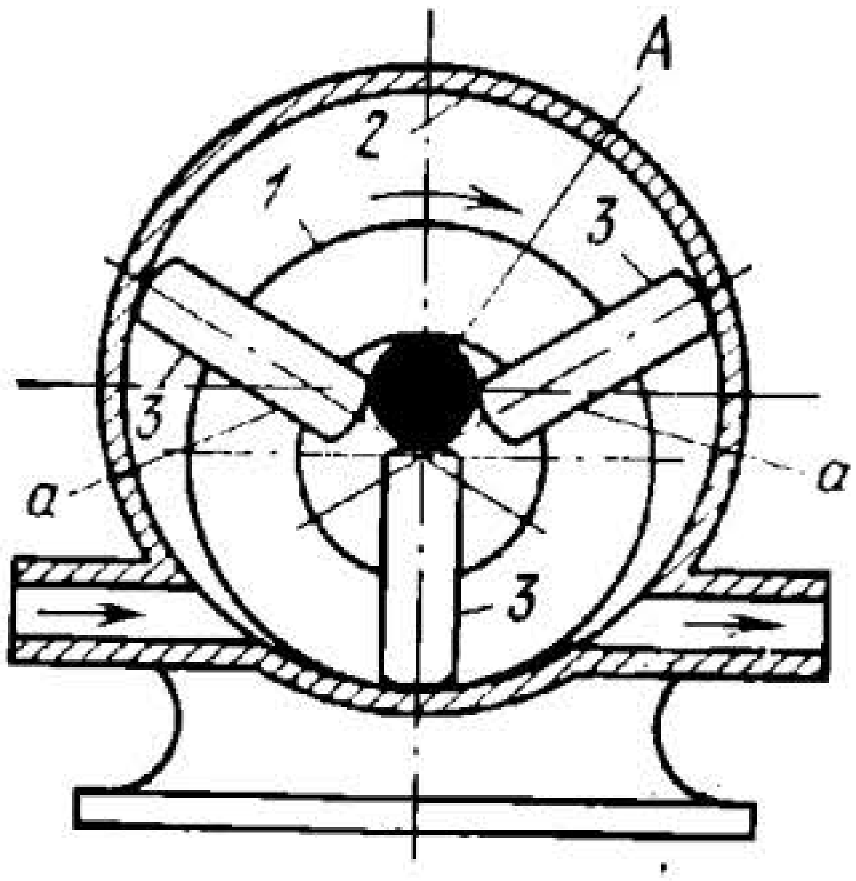
Shaped rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Vanes *3* and *4* turn about axes *B*. When the rotor rotates, vanes *3* and *4* are held against the housing by centrifugal force. In the position shown, liquid is drawn in from suction input *b*, while discharge output *e* is closed by vane *4*. The action of the vanes alternates.

3792	VANE ROTARY PUMP MECHANISM WITH FREE CYLINDERS	LHP RP

Rotor *1*, having four rigid vanes *a*, rotates about a fixed axis, eccentrically located with respect to the geometric axis of housing *2*. Four cylinders *3* can roll and slide freely along the internal surface of housing *2* and along vanes *a*. When rotor *1* rotates, cylinders *3* are held constantly against the internal wall of housing *2* by centrifugal force, forming the necessary seals between the rotor and housing.

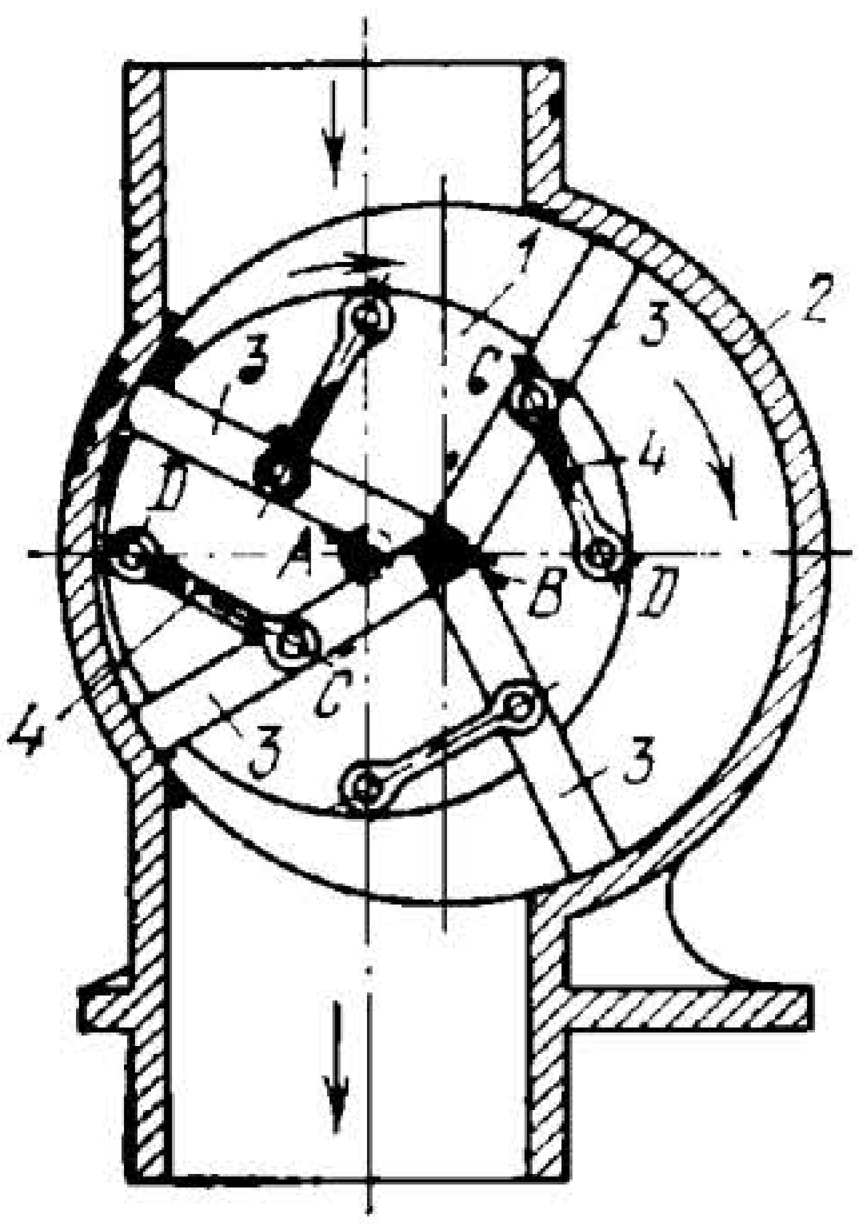


3793	ECCENTRIC-ROTOR SLIDING-VANE ROTARY PUMP MECHANISM	LHP RP



Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *2*. Vanes *3* slide in slots *a* of the rotor. When rotor *1* rotates, liquid is delivered in the direction of the arrows. Vanes *3* are held constantly against the internal surface of housing *2* by centrifugal force, and separate the suction and discharge chambers.

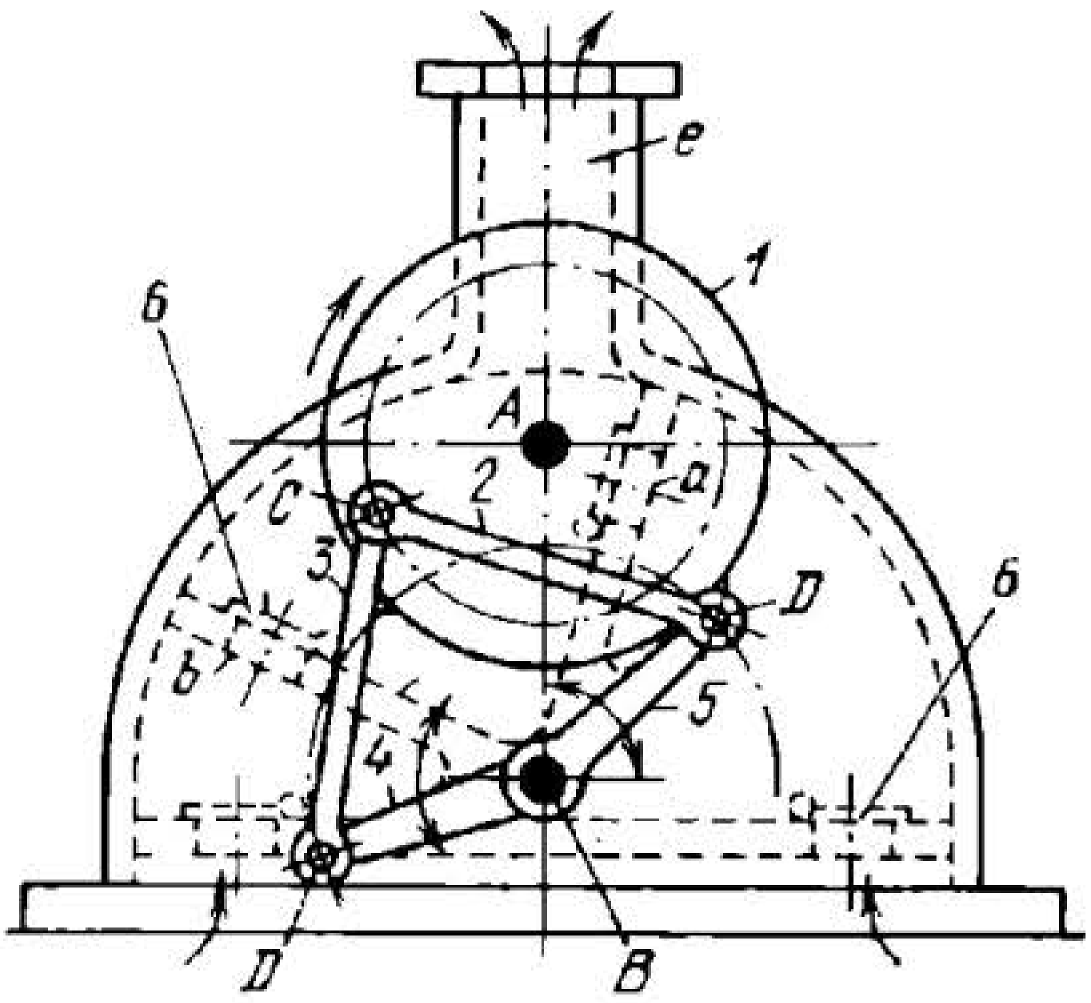
3794	LINKWORK MECHANISM OF A FOUR HINGED-VANE ROTARY PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Four vanes *3* rotate about fixed axis *B*, coinciding with the geometric axis of housing *2*. Links *4* are connected by turning pairs *C* and *D* to vanes *3* and rotor *1*. When rotor *1* rotates, liquid is delivered in the direction of the arrows.

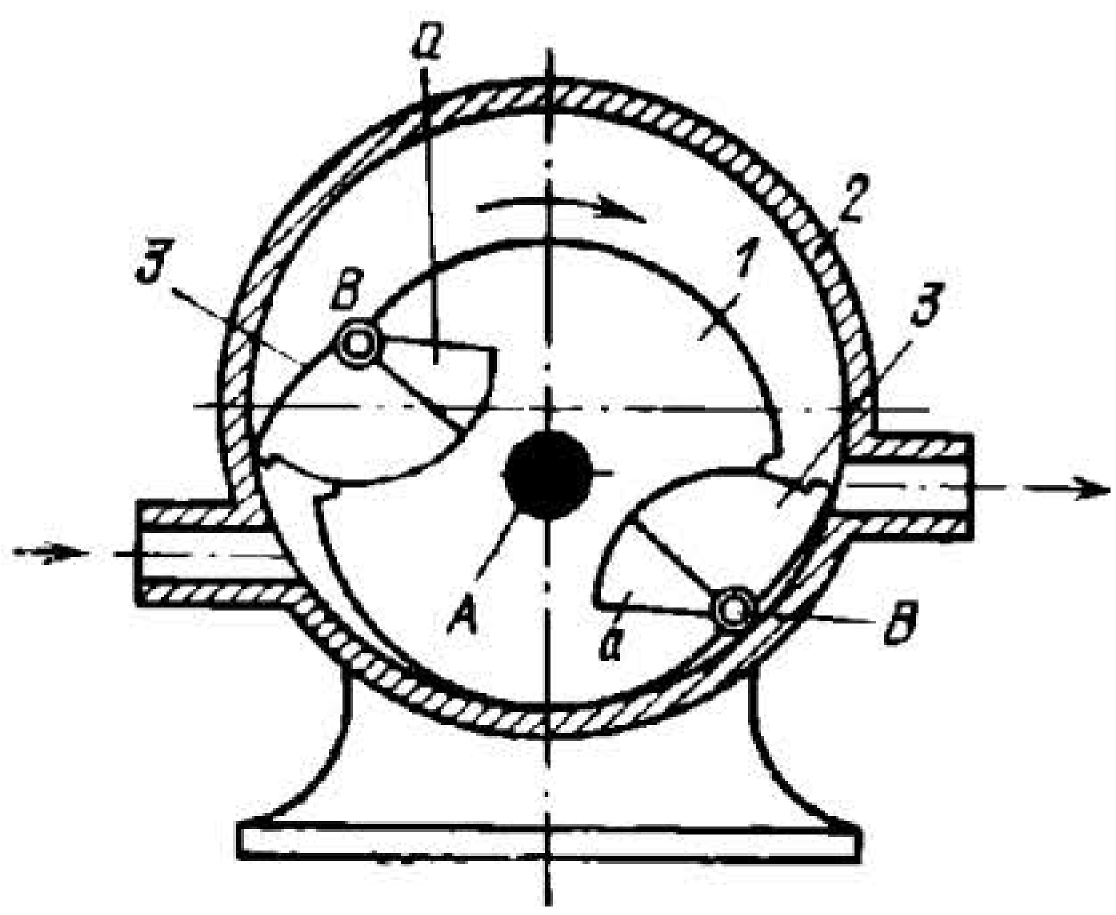
3795	LINKWORK MECHANISM OF A SWINGING VANE AIR BLOWER	LHP RP

Disk 1 rotates about fixed axis A. Levers 4 and 5 turn about fixed axis B and are rigidly attached, one each, to vanes b and a. When disk 1 rotates, vanes a and b are oscillated with levers 5 and 4 by links 2 and 3, connected by turning pairs C and D to disk 1 and levers 5 and 4. Vanes a and b have flap check valves 6 which open when the vanes swing downward and close when they swing upward. When disk 1 rotates, vanes a and b pump air out through pipe e.

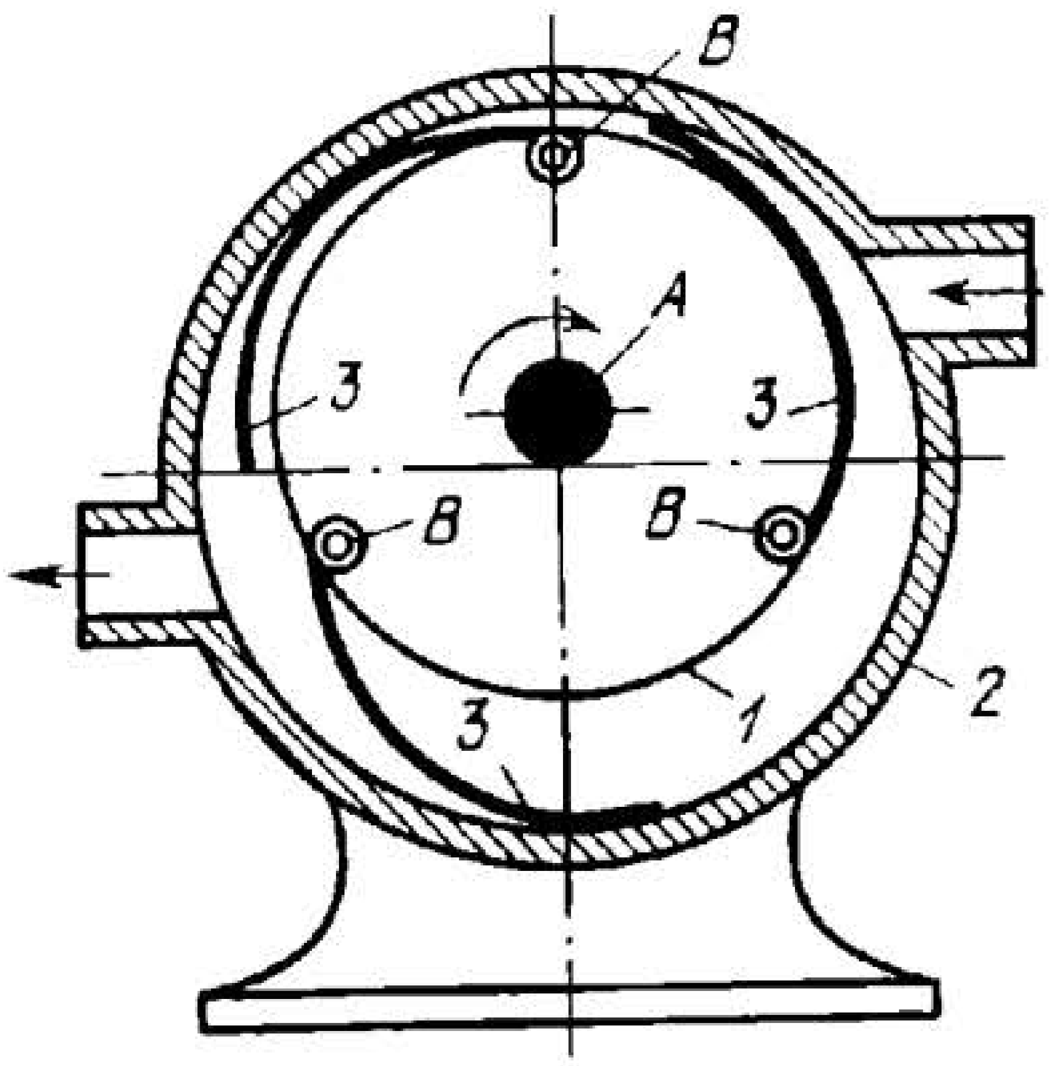


3796	LEVER MECHANISM OF A DOUBLE SECTOR-VANE ROTARY PUMP	LHP RP

Circular rotor 1 rotates about fixed axis A, eccentrically located with respect to the geometric axis of housing 2. Vanes 3, of sector shape, turn about axes B. When rotor 1 rotates, liquid is delivered in the direction of the arrows. The vanes are held against the internal surface of housing 2 by centrifugal force, and are retracted into recesses a in rotor 1.

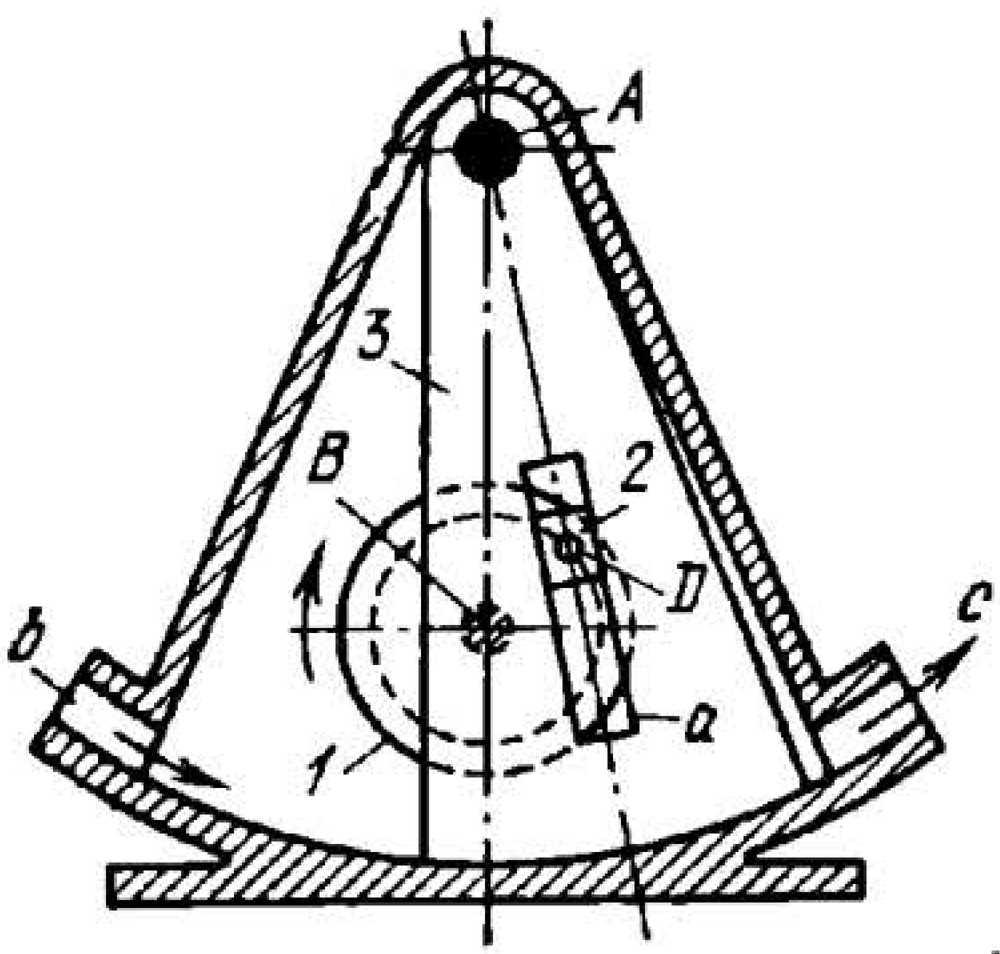


3797	LEVER MECHANISM OF A TRIPLE HINGED-ELASTIC-VANE ROTARY PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Elastic vanes *3* turn about axes *B*. When rotor *1* rotates, vanes *3* are held against the internal surface of housing *2* by centrifugal force and deliver liquid in the direction of the arrows.

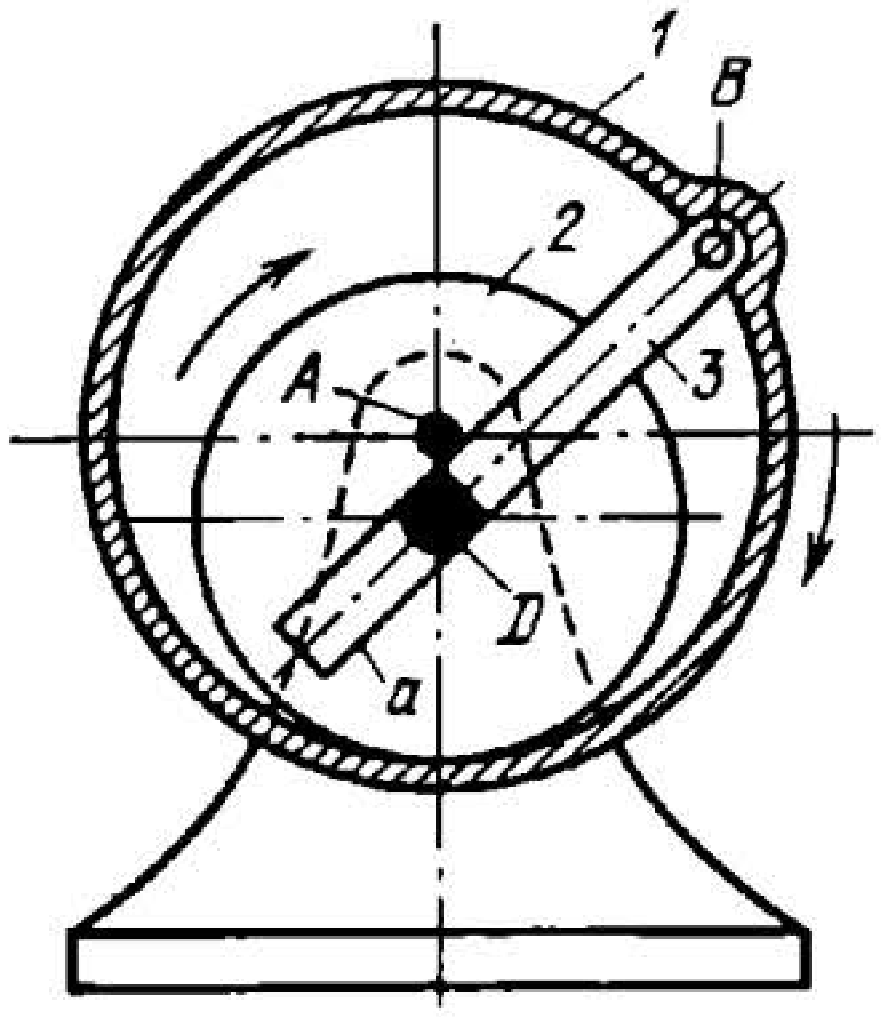
3798	LINK-GEAR MECHANISM OF SEMIROTARY VANE PUMP	LHP RP



Disk *1* rotates about fixed axis *B* and is connected by turning pair *D* to slider *2* which reciprocates in slot *a* of vane *3*. Vane *3* turns about fixed axis *A*. When vane *3* swings to the right, liquid is drawn in from suction input *b* and is delivered through discharge output *c*. When vane *3* swings back to the left, liquid passes through a check valve (not shown) in the vane to the discharge chamber at the right of the vane, and suction inlet *b* is closed by another check valve (not shown) to prevent reverse flow of the liquid.

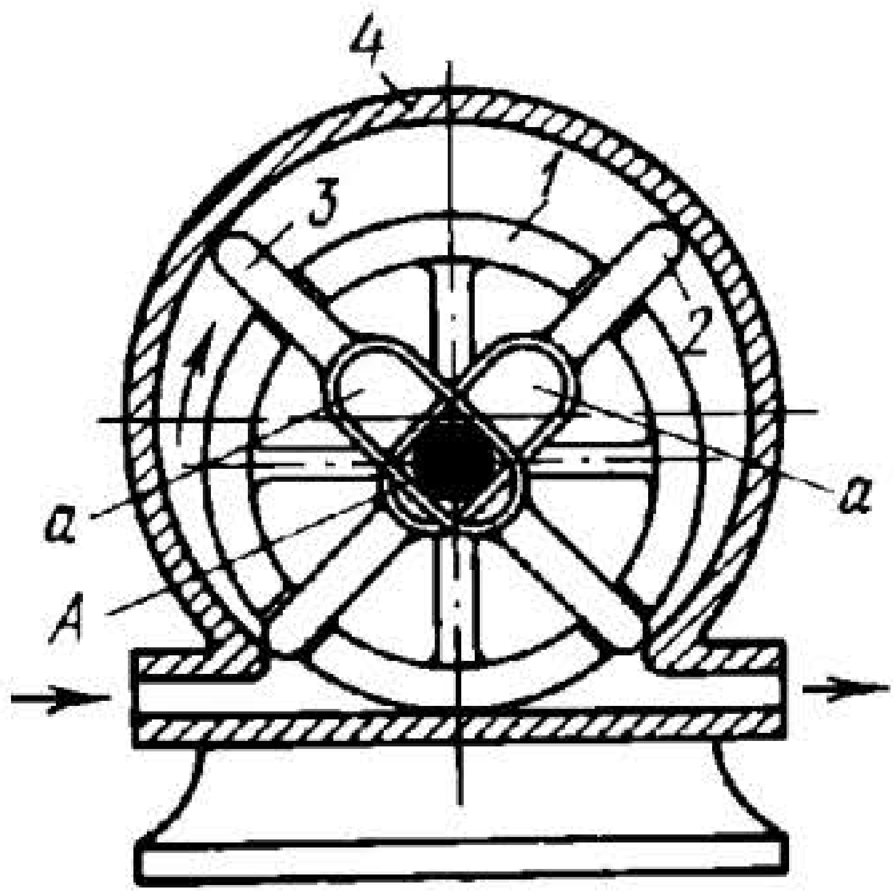
3799	LINK-GEAR MECHANISM OF A HINGED-VANE PUMP	LHP RP

Housing *1* rotates about fixed axis *A* and is connected by turning pair *B* to vane *3* which slides in slot *a* of disk *2*. Disk *2* rotates about fixed axis *D*. When housing *1* rotates, vane *3* reciprocates in slot *a* of disk *2*, rotating the disk and delivering liquid in the direction of the arrows.

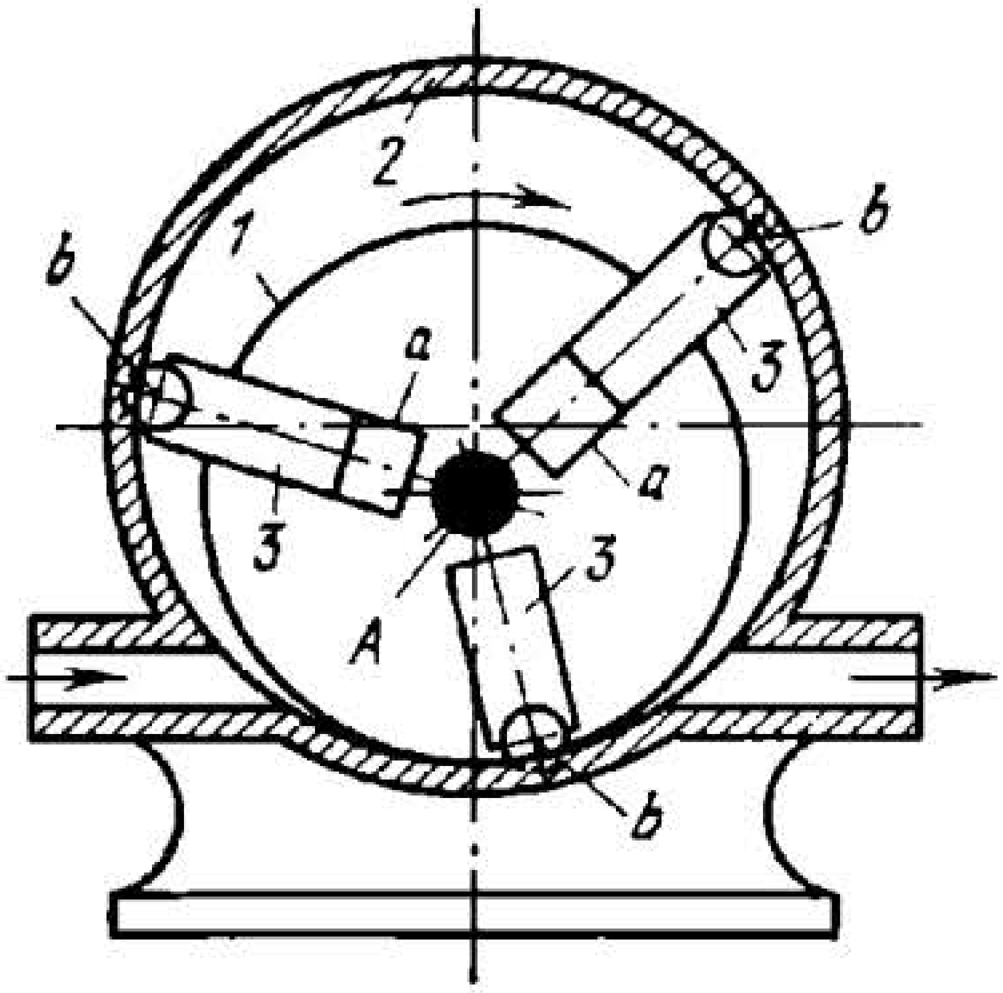


3800	LINK-GEAR MECHANISM OF A ROTARY VANE PUMP	LHP RP

Ring *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *4*. Ring *1* has slots in which vanes *2* and *3* slide. Vanes *2* and *3* have slots *a* which envelope axis *A*. When ring *1* rotates, vanes *2* and *3* deliver liquid in the direction of the arrows.

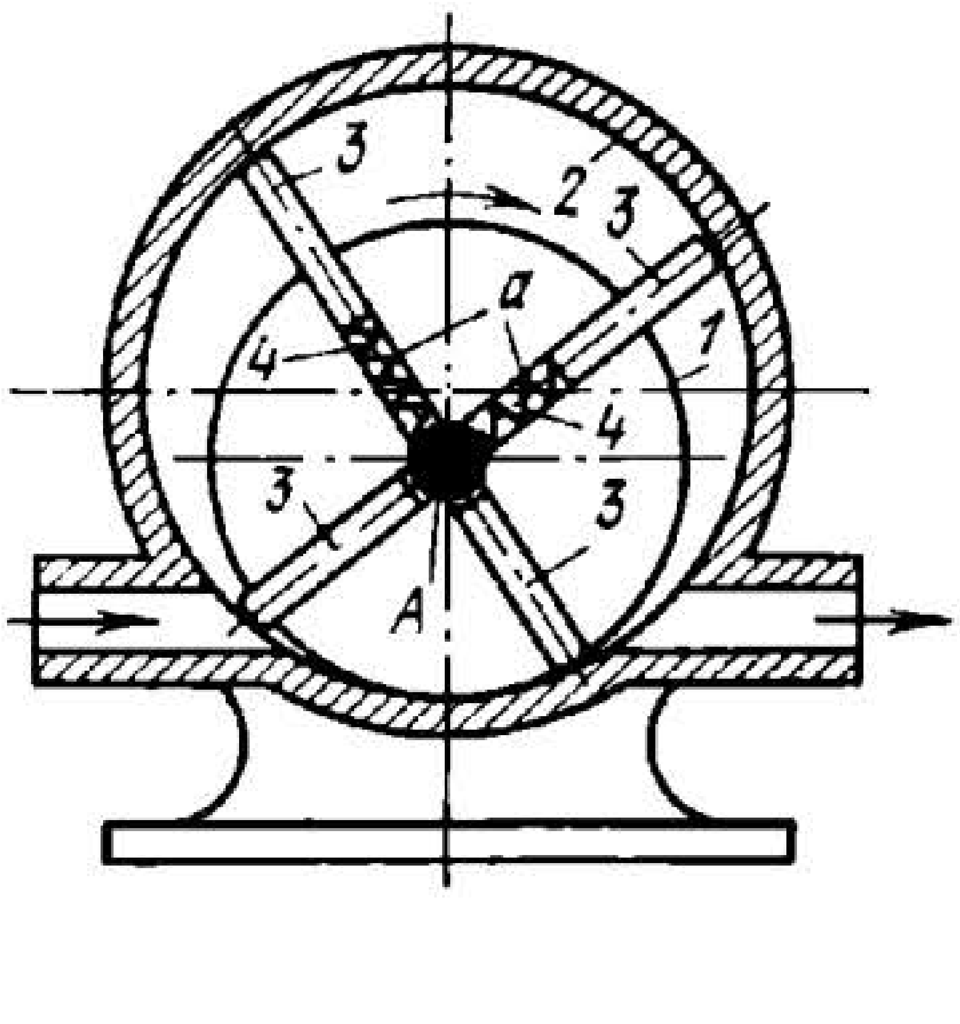


3801	LINK-GEAR MECHANISM OF A ROTARY FREE-VANE PUMP	LHP RP



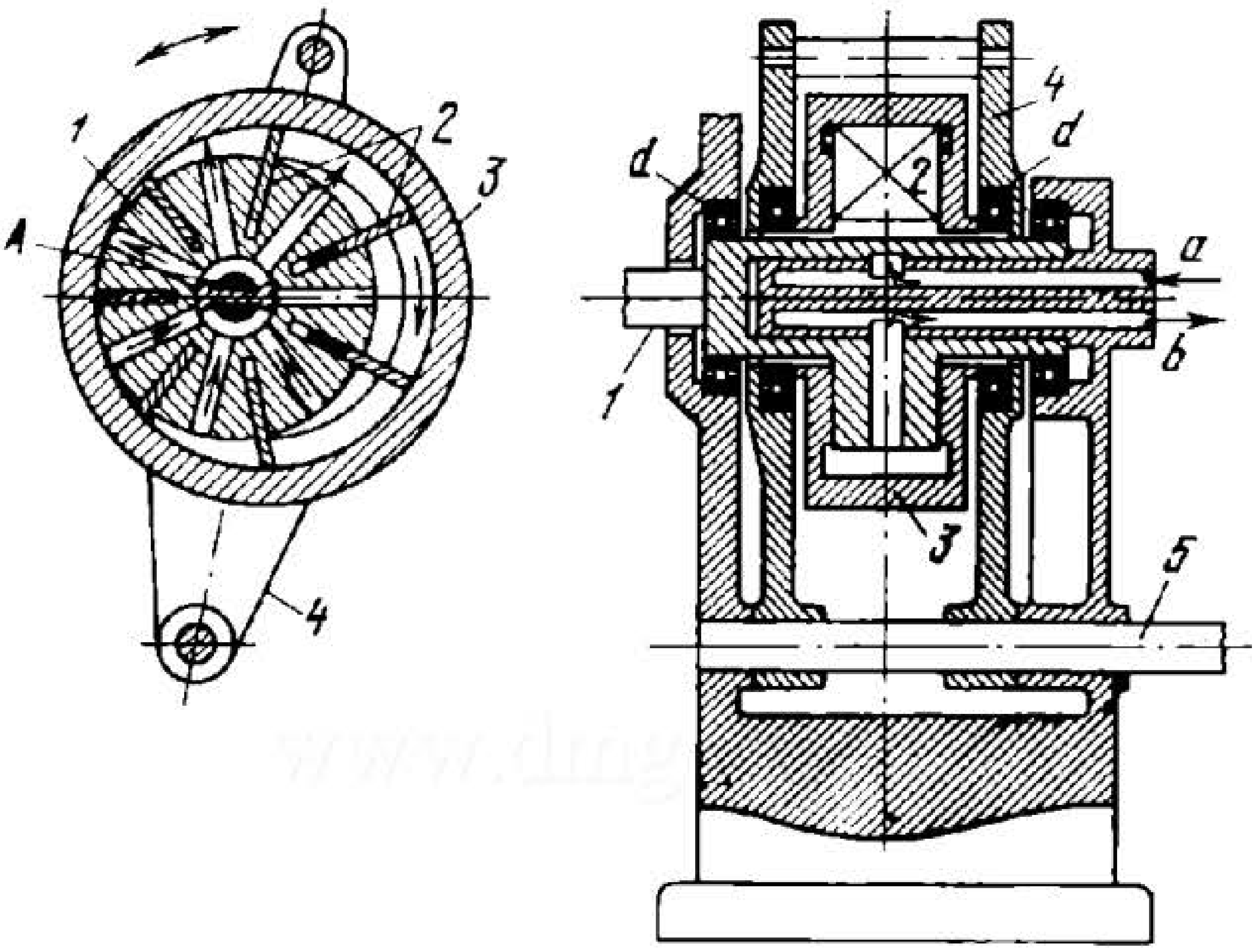
Rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Rotor *1* has three slots *a* in which vanes *3* slide. The vanes have steel balls *b* at their outer ends and are held constantly against the internal surface of housing *2* by centrifugal force. When rotor *1* rotates, the vanes deliver liquid in the direction of the arrows.

3802	LINK-GEAR MECHANISM OF A ROTARY SPRING-LOADED-VANE PUMP	LHP RP



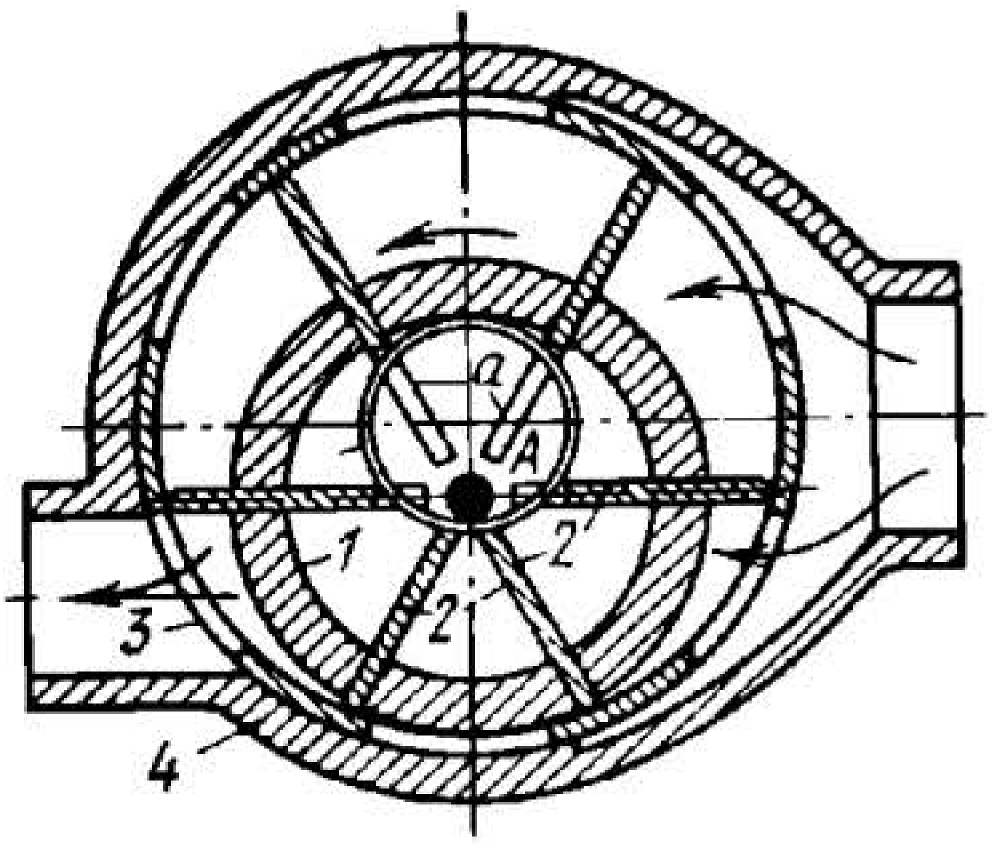
Rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Rotor *1* has four slots *a* in which vanes *3* slide. Springs *4* hold the vanes constantly against the internal surface of housing *2*. When rotor *1* rotates, vanes *3* deliver liquid in the direction of the arrows.

3803	LINK-GEAR MECHANISM OF A ROTARY MULTIPLE-VANE VARIABLE-DISPLACEMENT PUMP	LHP RP



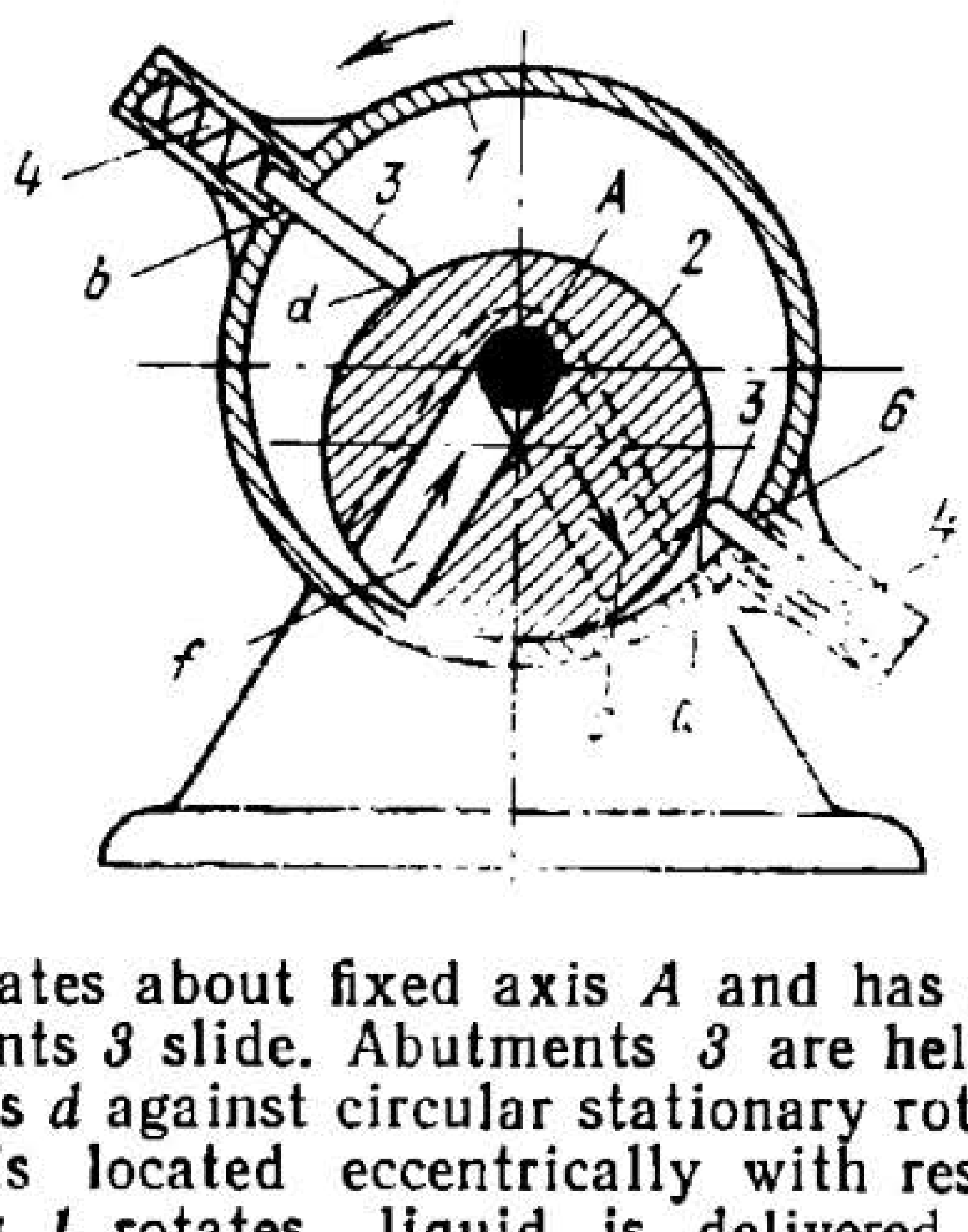
Rotor *1* rotates about fixed axis *A* and has seven vanes *2* sliding in radial slots of the rotor. When rotor *1* rotates, vanes *2* are held against the internal surface of cylindrical housing *3*, located eccentrically with respect to centre *A* of rotor *1*. The suction and discharge chambers are formed between vanes *2*, rotor *1* and housing *3*. Housing *3* is mounted in ball bearings *d* in yoke member *4*. Turning yoke member *4* about shaft *5* increases or reduces the eccentricity of housing *3* with respect to rotor *1*. This increases or reduces the delivery of liquid. Channels *a* and *b* in the rotor shaft are for the suction and discharge of the liquid.

3804	**LINK-GEAR MECHANISM OF A ROTARY VANE PUMP**	LHP RP



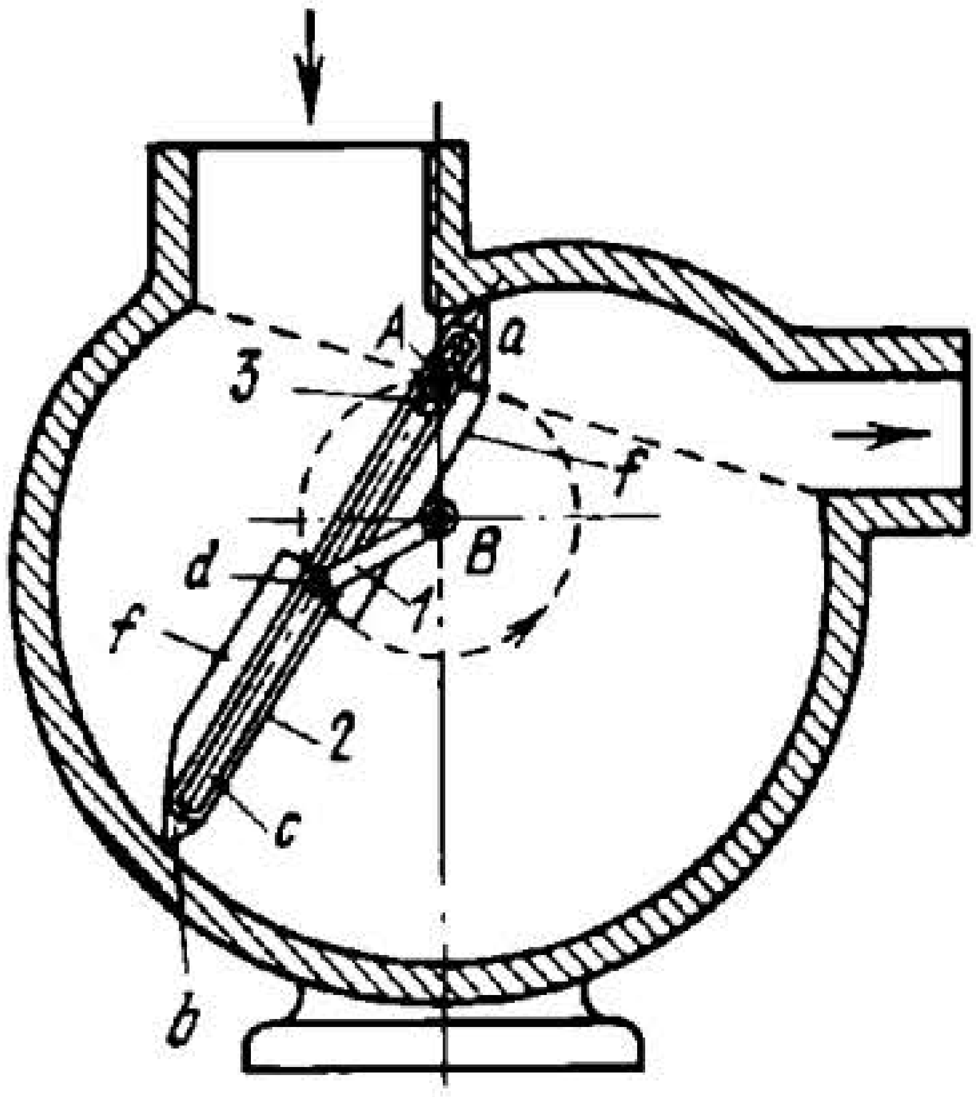
Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *4*. Vanes *2* slide freely in radial slots *a* of rotor *1*. Guide ring *3* has ports for fluid flow. When rotor *1* rotates, vanes *2* are held against the internal surface of guide ring *3* by centrifugal force and deliver fluid (liquid or gas) in the direction of the arrows. Suction and discharge chambers are formed between housing *4*, guide ring *3*, vanes *2* and rotor *1*.

3805	**LINK-GEAR MECHANISM OF A SLIDING-ABUTMENT ROTARY-HOUSING PUMP**	LHP RP



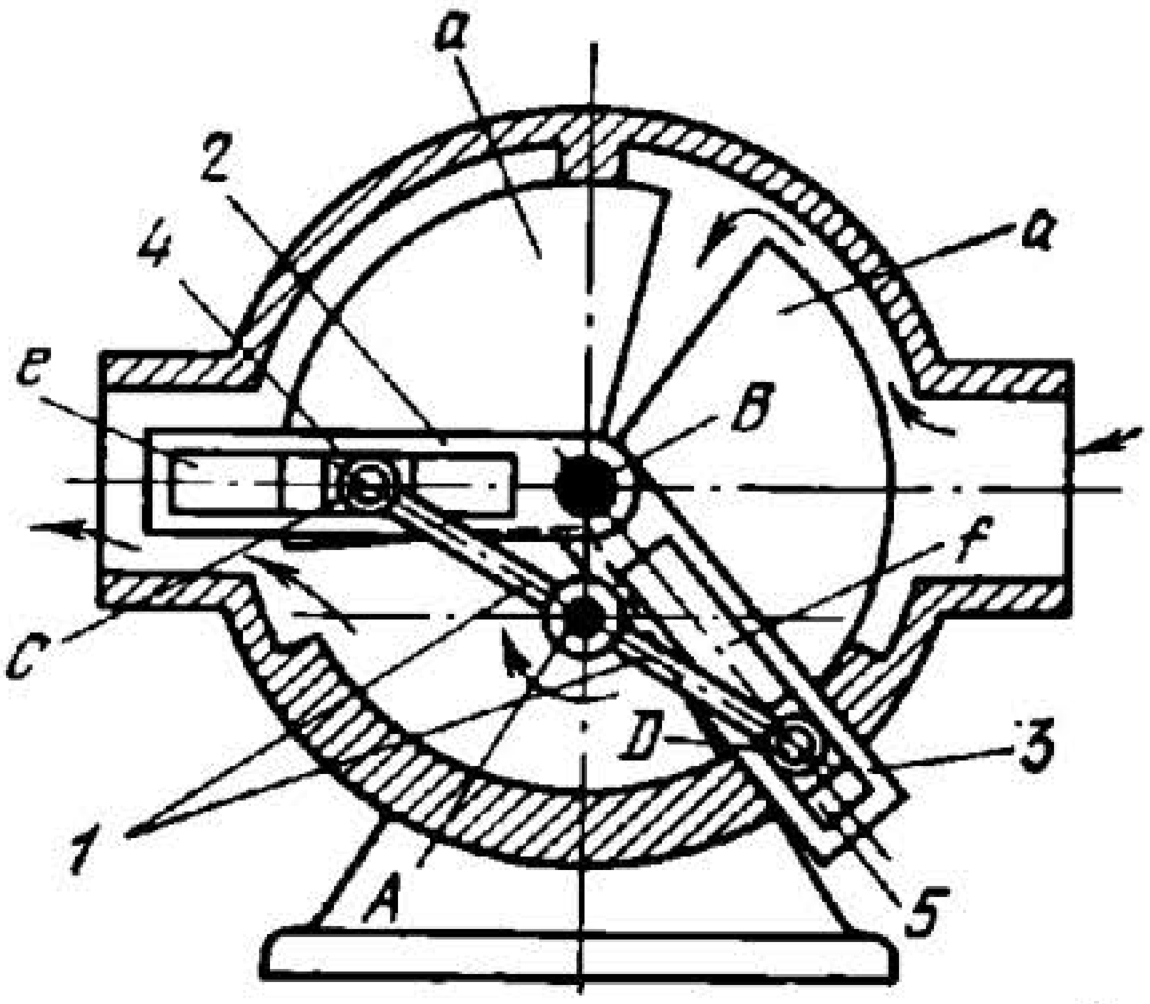
Housing *1* rotates about fixed axis *A* and has guide-slots *b* in which abutments *3* slide. Abutments *3* are held by springs *4* with their ends *d* against circular stationary rotor *2* whose geometric axis is located eccentrically with respect to axis *A*. When housing *1* rotates, liquid is delivered as shown along channels *f* and *e*.

3806	LINK-GEAR MECHANISM OF A SPIRAL-HOUSING ROTARY VANE PUMP	LHP RP



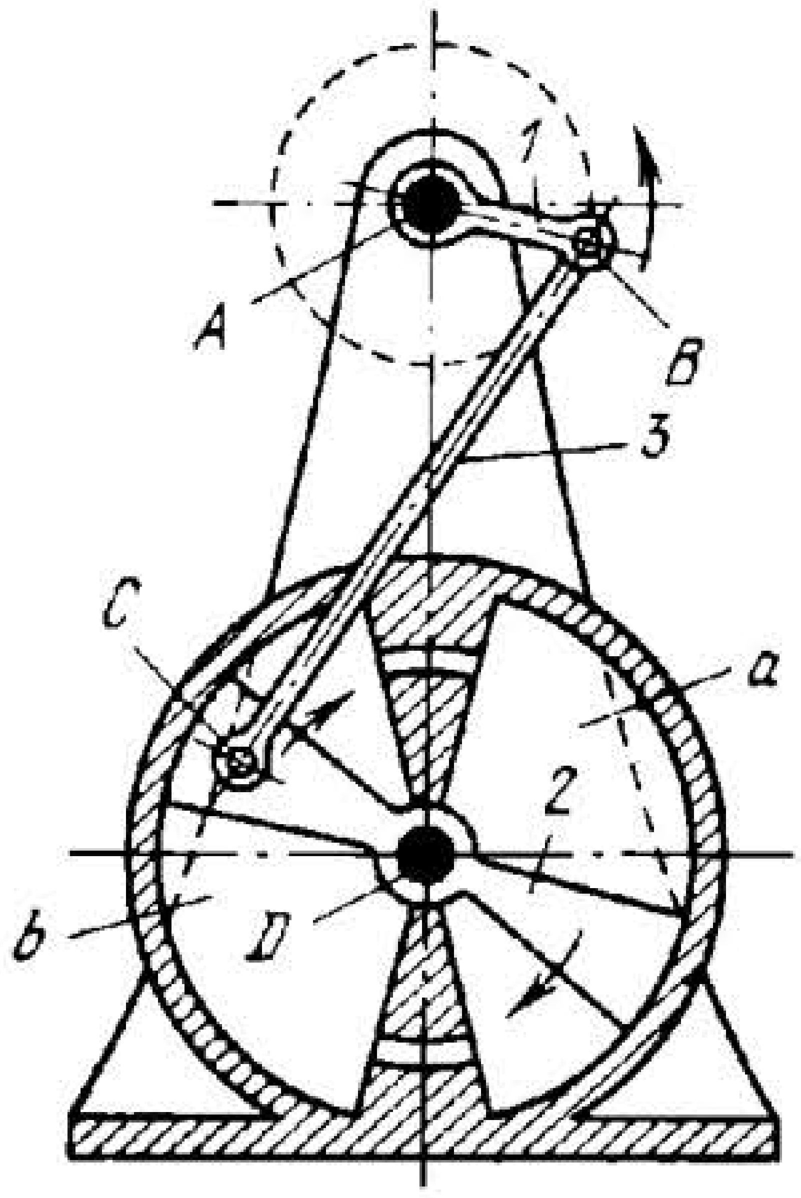
Crank *1* rotates about fixed axis *B* and has pin *d* sliding along slot *c* of member *2*. Member *2* is connected by a sliding pair to slider *3* which rotates about fixed axis *A*. Vanes *f*, rigidly attached to member *2*, slide with their ends *a* and *b* along the internal surface of the housing which has the shape of a limaçon of Pascal. Liquid is delivered in the direction of the arrows.

3807	LINK-GEAR MECHANISM OF A ROTARY SECTOR-VANE PUMP	LHP RP



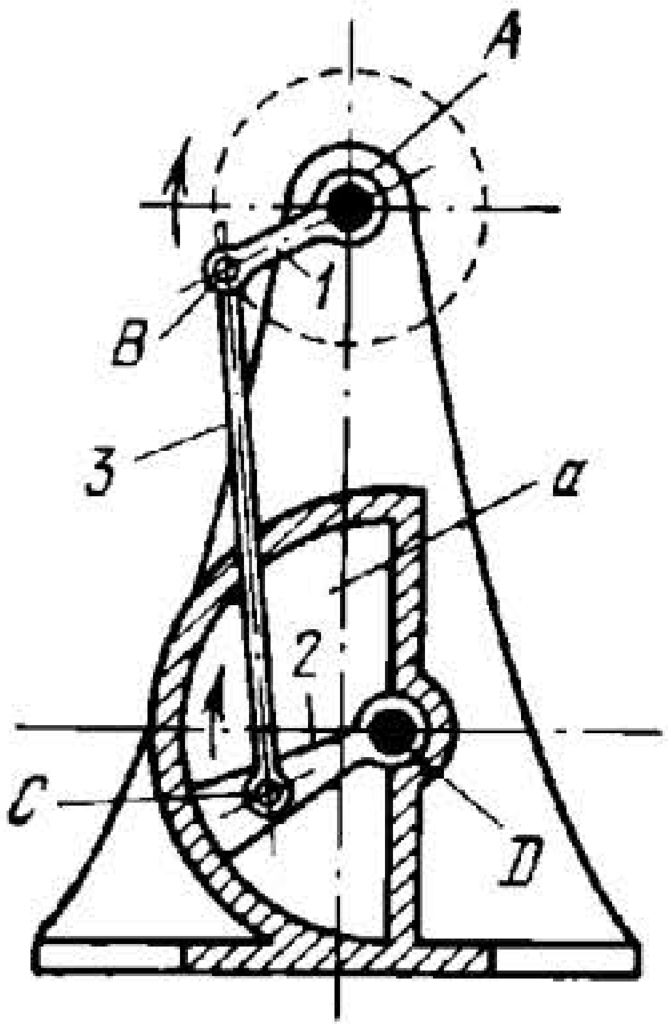
Double crank *1* rotates about fixed axis *A* and is connected by turning pairs *C* and *D* to sliders *4* and *5*, which slide along slots *e* and *f* of links *2* and *3*. Links *2* and *3* rotate about common fixed axis *B*. Rigidly secured to links *2* and *3* are equal sectors *a*. When crank *1* rotates, sectors *a* deliver liquid in the direction of the arrows.

3808	**LINKWORK MECHANISM OF A TWO-CHAMBER SEMIROTARY VANE PUMP**	**LHP RP**



Crank 1 rotates about fixed axis A. Two-blade vane 2 oscillates about fixed axis D. Connecting rod 3 is connected by turning pairs B and C to crank 1 and vane 2. The pump has two chambers, a and b. When crank 1 rotates, vane 2 delivers liquid clockwise and separates the suction and discharge chambers which are connected to chambers a and b.

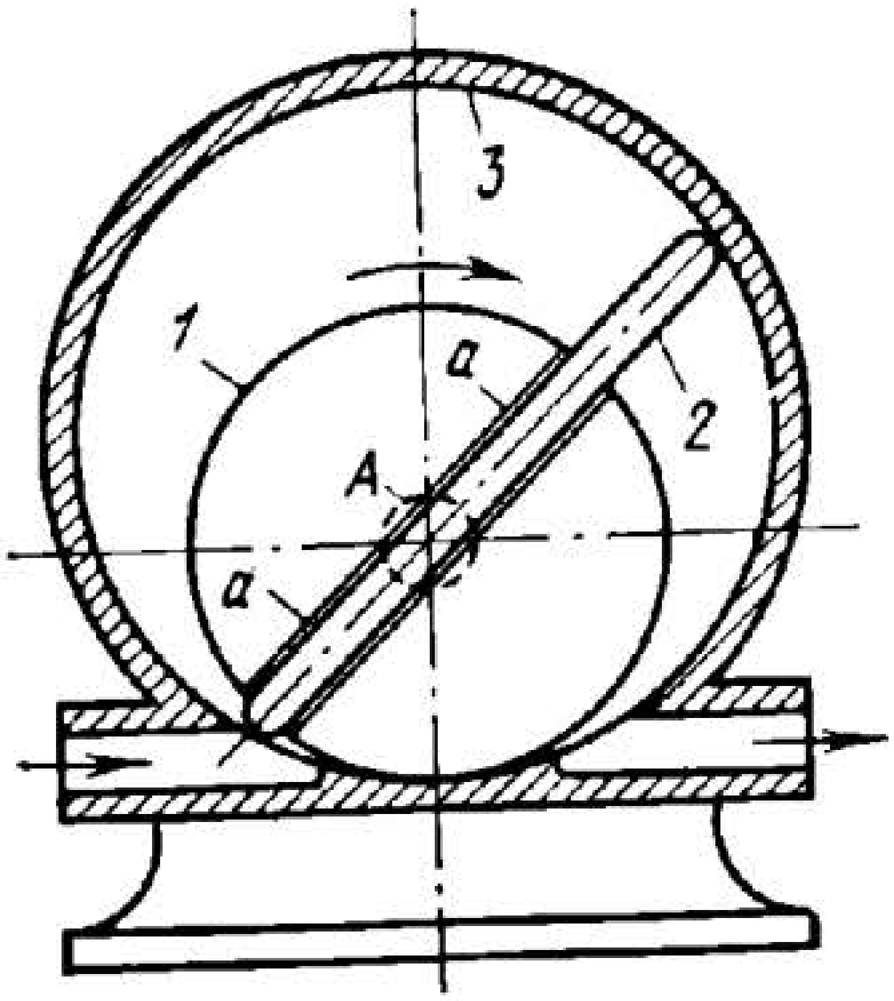
3809	**LINKWORK MECHANISM OF A SINGLE-CHAMBER SEMIROTARY VANE PUMP**	**LHP RP**



Crank 1 rotates about fixed axis A. Vane 2 oscillates about fixed axis D. Connecting rod 3 is connected by turning pairs B and C to crank 1 and vane 2. The pump has one chamber a. When crank 1 rotates, vane 2 delivers liquid clockwise and separates the suction and discharge chambers. Vane 2 has a check valve (not shown) for the liquid to pass through on the return stroke.

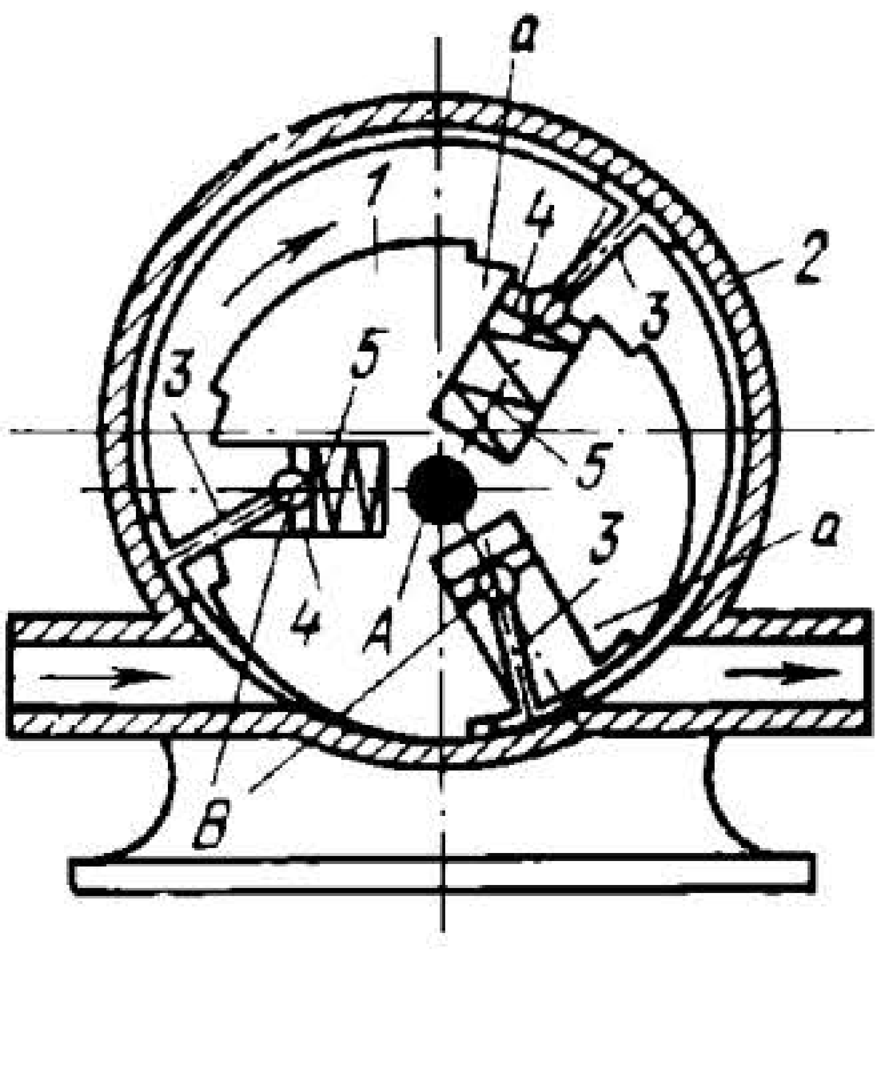
3810	LINK-GEAR MECHANISM OF A ROTARY VANE PUMP WITH A CARDIOID-SHAPED HOUSING	LHP RP

Circular rotor 1 rotates about fixed axis A and has diametral slot a in which vane 2 slides. The internal surface of housing 3 has the shape of a cardioid with its pole at point A. When rotor 1 rotates, vane 2 slides with its ends along the internal surface of housing 3, delivering liquid in the direction of the arrows.

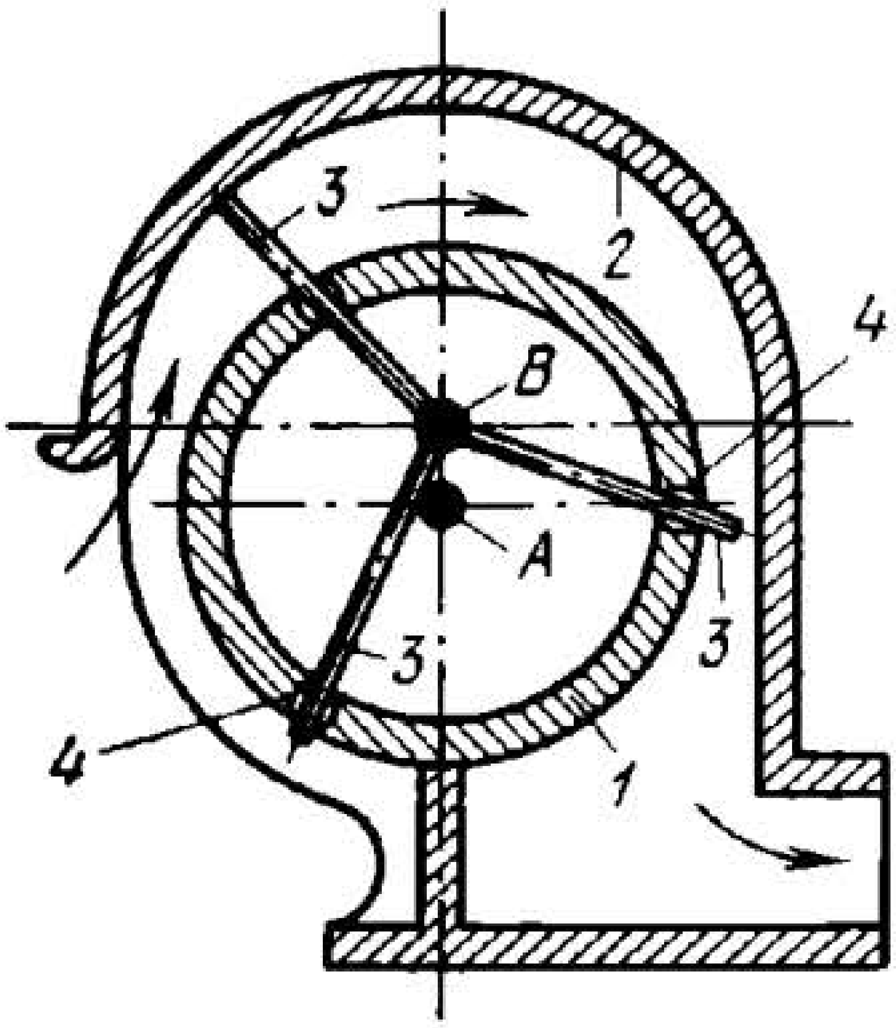


3811	LINK-GEAR MECHANISM OF A ROTARY VANE PUMP	LHP RP

Circular rotor 1 rotates about fixed axis A, eccentrically located with respect to the geometric axis of housing 2. Rotor 1 has three separate guides a in which pistons 4 slide. Pistons 4 are actuated by springs 5. Vanes 3 are connected by turning pairs B to pistons 4. When rotor 1 rotates, vanes 3 are held constantly against the internal surface of housing 2 and deliver liquid in the direction of the arrows.

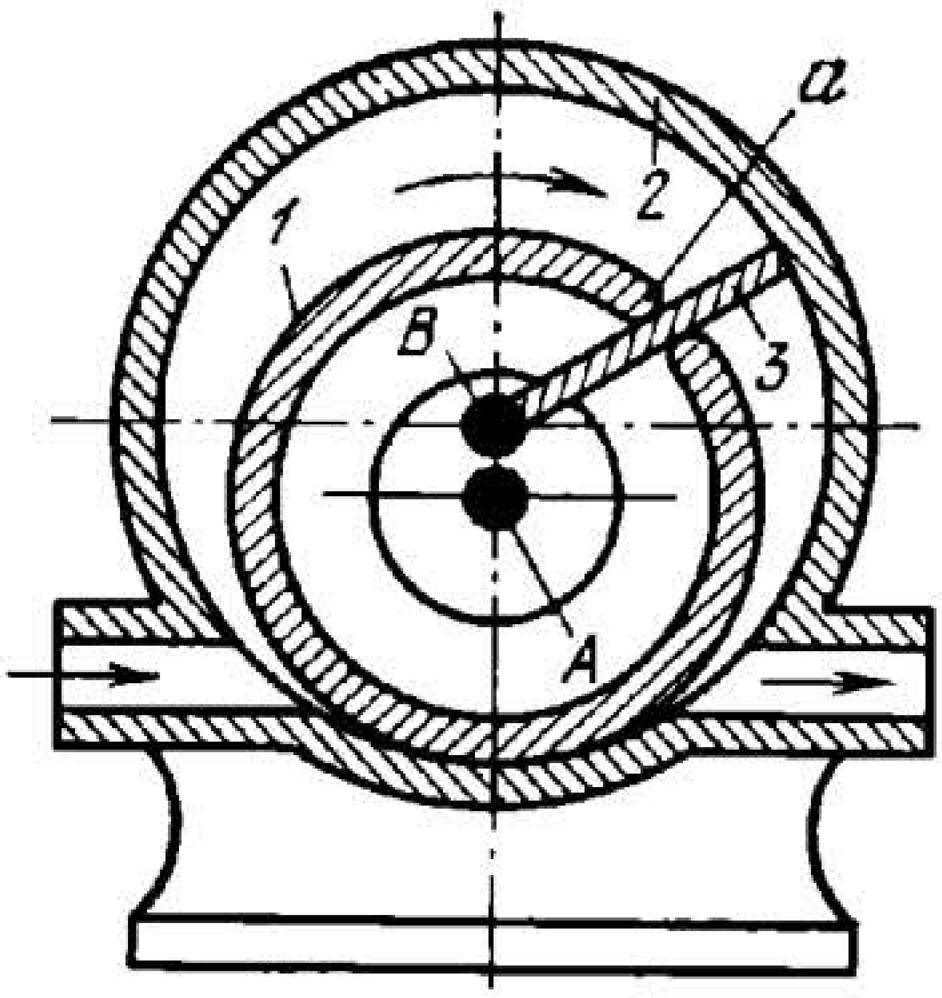


3812	LINK-GEAR MECHANISM OF A ROTARY THREE-VANE PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to geometric axis *B* of housing *2*. Vanes *3* rotate about fixed axis *B* and slide in bearing members *4* which are connected by turning pairs to rotor *1*. When rotor *1* rotates, vanes *3* deliver liquid in the direction of the arrows.

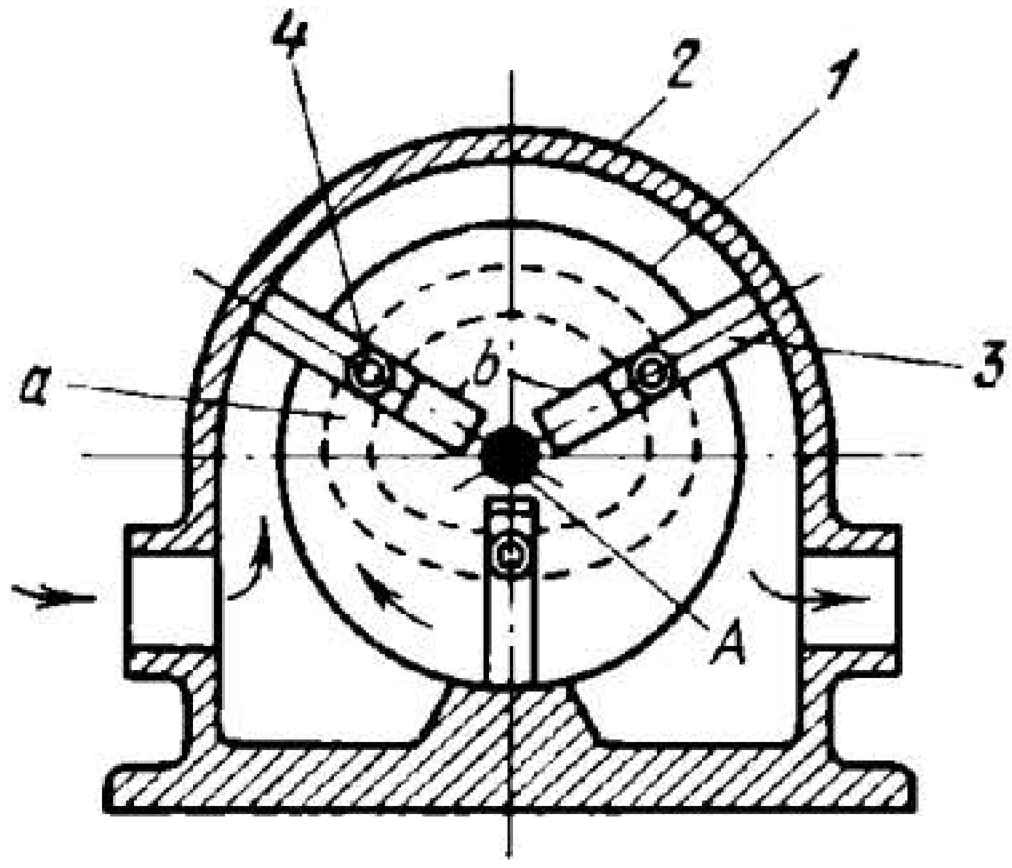
3813	LINK-GEAR MECHANISM OF A ROTARY VANE PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to geometric axis *B* of housing *2*. Vane *3* rotates about fixed axis *B* and slides in arc-shaped slot *a* of rotor *1*. When rotor *1* rotates, vane *3* delivers liquid in the direction of the arrows.

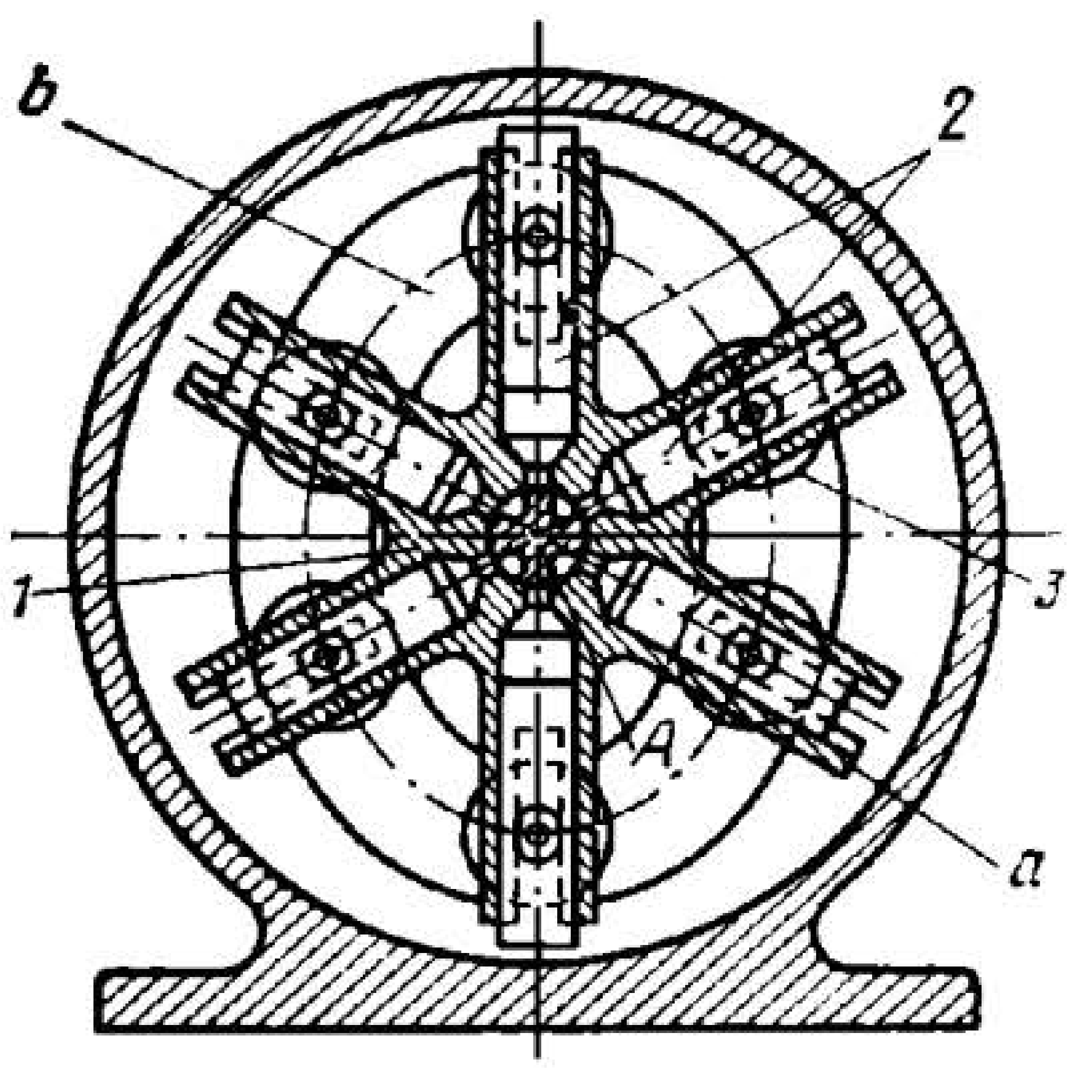
3814	LINK-GEAR-CAM MECHANISM OF A ROTARY VANE PUMP	LHP RP

Rotor *1*, having three symmetrical guide slots *b*, rotates about fixed axis *A*. Vanes *3*, sliding along slots *b*, have rollers *4* which slide and roll in curvilinear profiled slot *a* in pump housing *2*. When rotor *1* rotates, vanes *3* deliver liquid in the direction of the arrows.

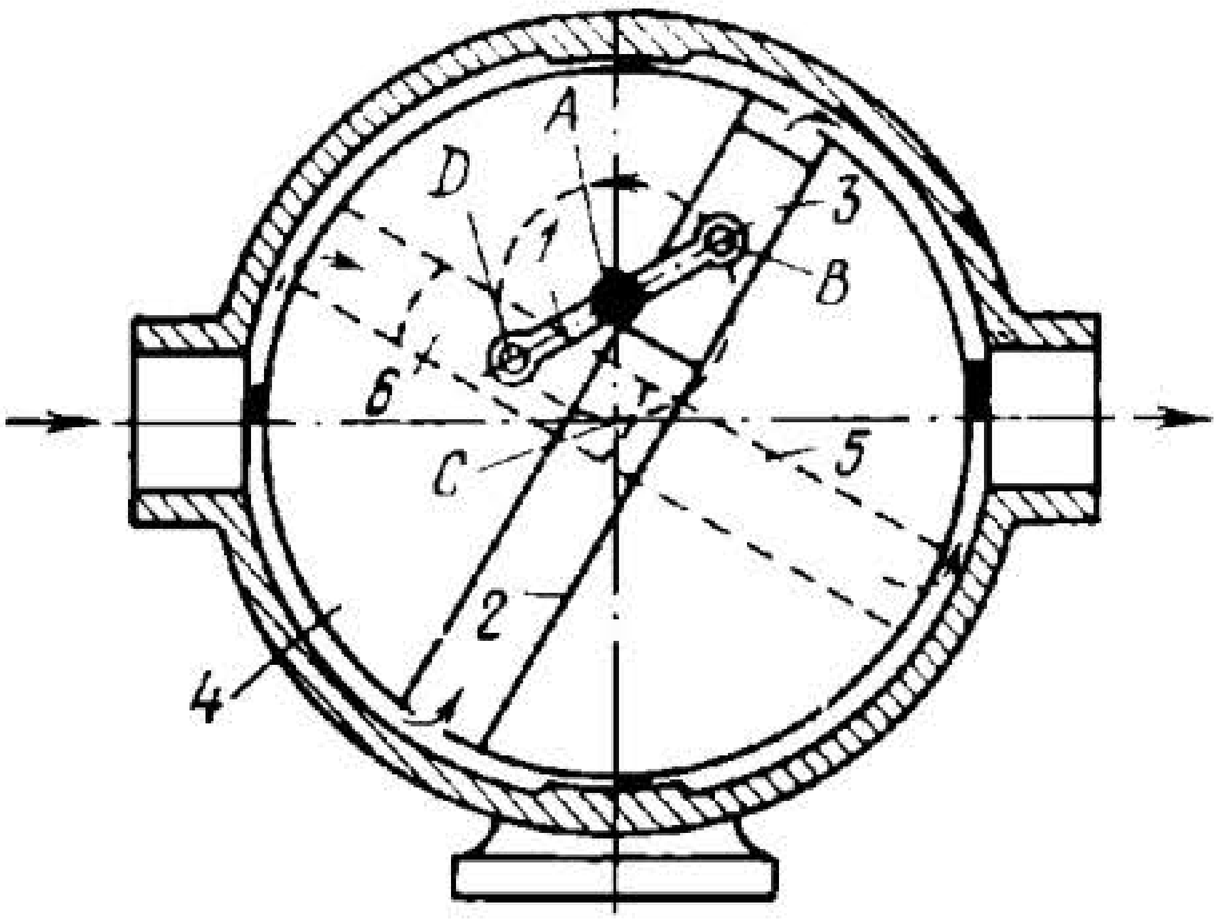


3815	LINK-GEAR-CAM MECHANISM OF A ROTARY PISTON PUMP	LHP RP

Cylinder block *1* consists of six symmetrically arranged cylinders *a* and rotates about fixed axis *A*. Reciprocating in the cylinders are pistons *2* which have rollers *3* that slide and roll along curvilinear profiled slot *b* in the housing. When cylinder block *1* rotates, pistons *2* reciprocate with respect to the cylinders which are used to pump a fluid (liquid or gas).

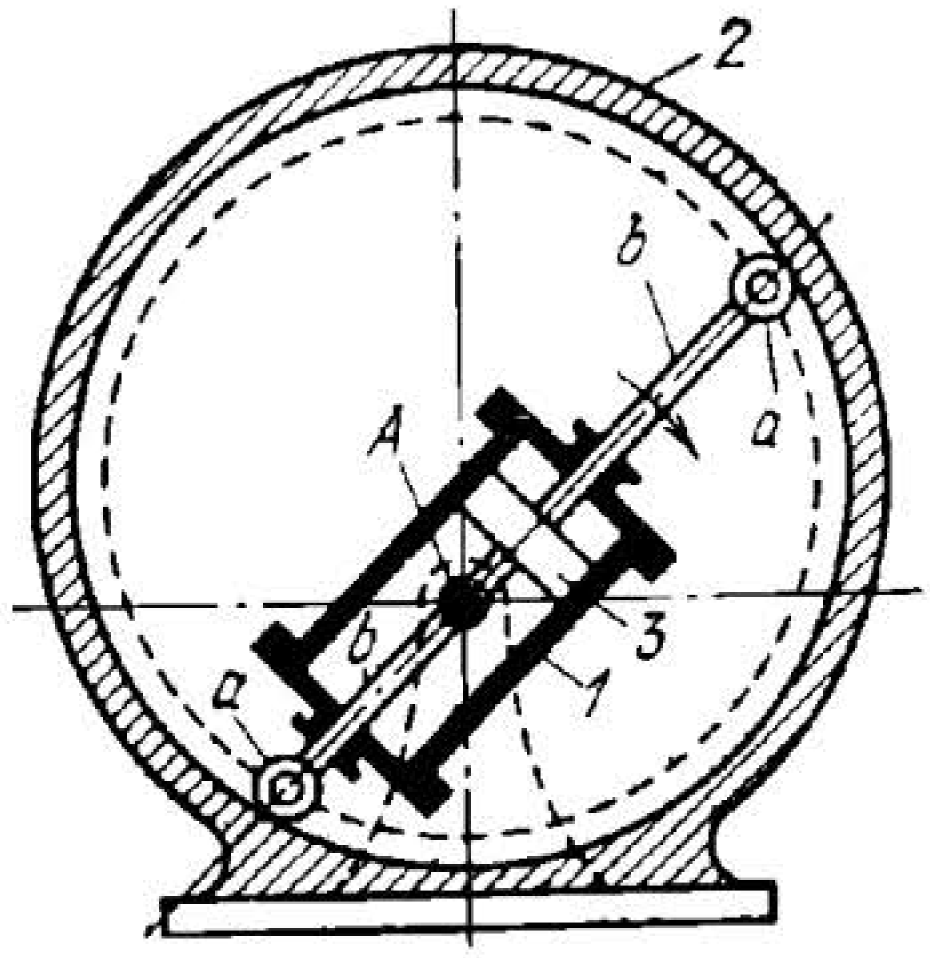


3816	LINK-GEAR MECHANISM OF A DOUBLE-CRANK ROTARY PISTON PUMP	LHP RP



Double crank *1* rotates about fixed axis *A* and is connected by turning pairs *B* and *D* to sliders *3* and *6* which reciprocate in guide slots *2* and *5* of rotor *4*. Rotor *4* rotates about fixed axis *C*. When crank *1* rotates, liquid is delivered in the direction of the arrows. Guide slot *5* and slider *6*, behind a partition, are shown by dash lines.

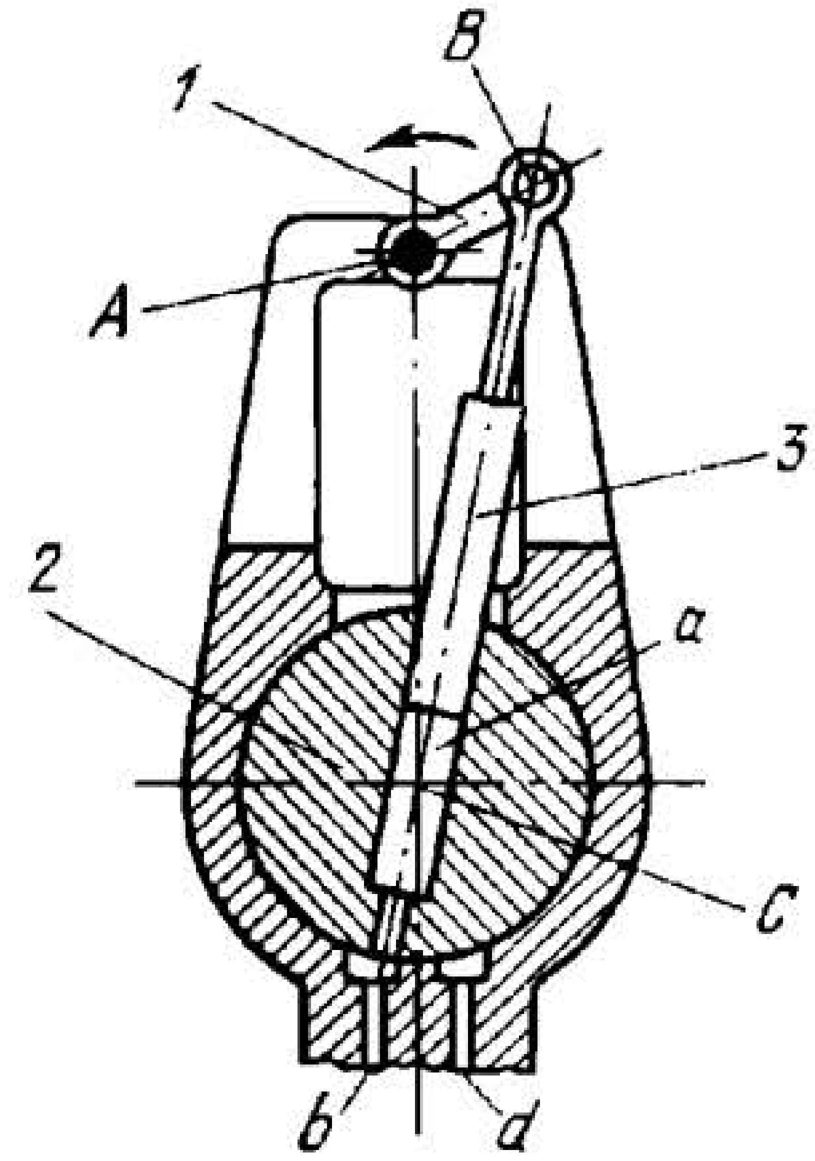
3817	LINK-GEAR MECHANISM OF A ROTARY PISTON PUMP WITH A HOUSING OF SPECIAL SHAPE	LHP RP



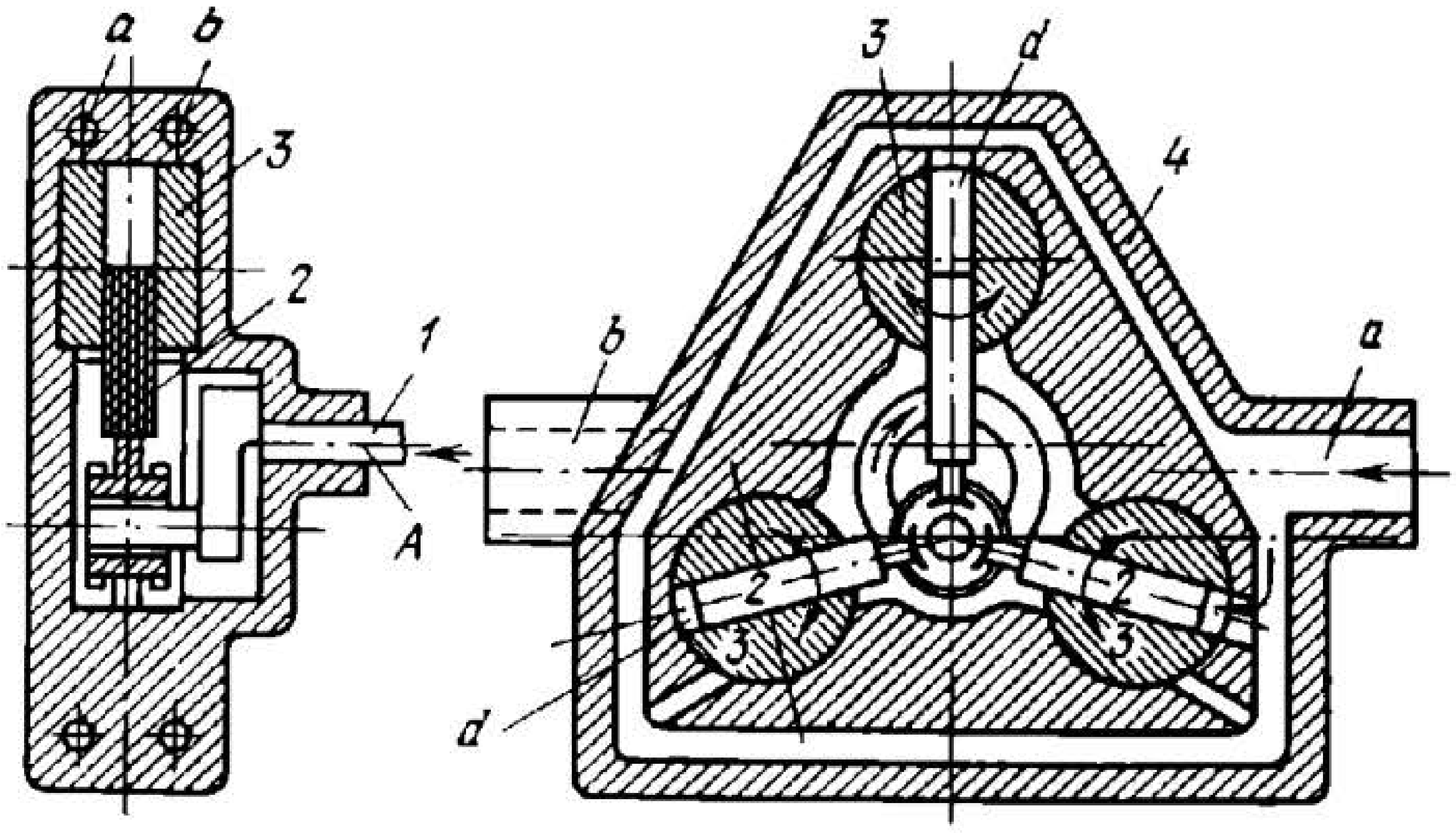
Cylinder *1* rotates about fixed axis *A*. Piston *3* reciprocates in cylinder *1* and has rod *b* with rollers *a* at its ends. The internal surface of the housing is profiled in such a manner that all the chords passing through axis *A* are of equal length. This shape may be, for example, a cardioid. When cylinder *1* rotates, rollers *a* roll around inside the housing and reciprocate pump piston *3*.

3818	LINK-GEAR MECHANISM OF AN OSCILLATING-CYLINDER PISTON PUMP	LHP RP

Crank *1* rotates about fixed axis *A* and is connected by turning pair *B* to piston *3* which reciprocates in bore *a* of cylinder *2*. Cylinder *2* turns about fixed axis *C*. When crank *1* rotates, cylinder *2* oscillates, alternately connecting the pump chamber with the suction and discharge ports *b* and *d*.

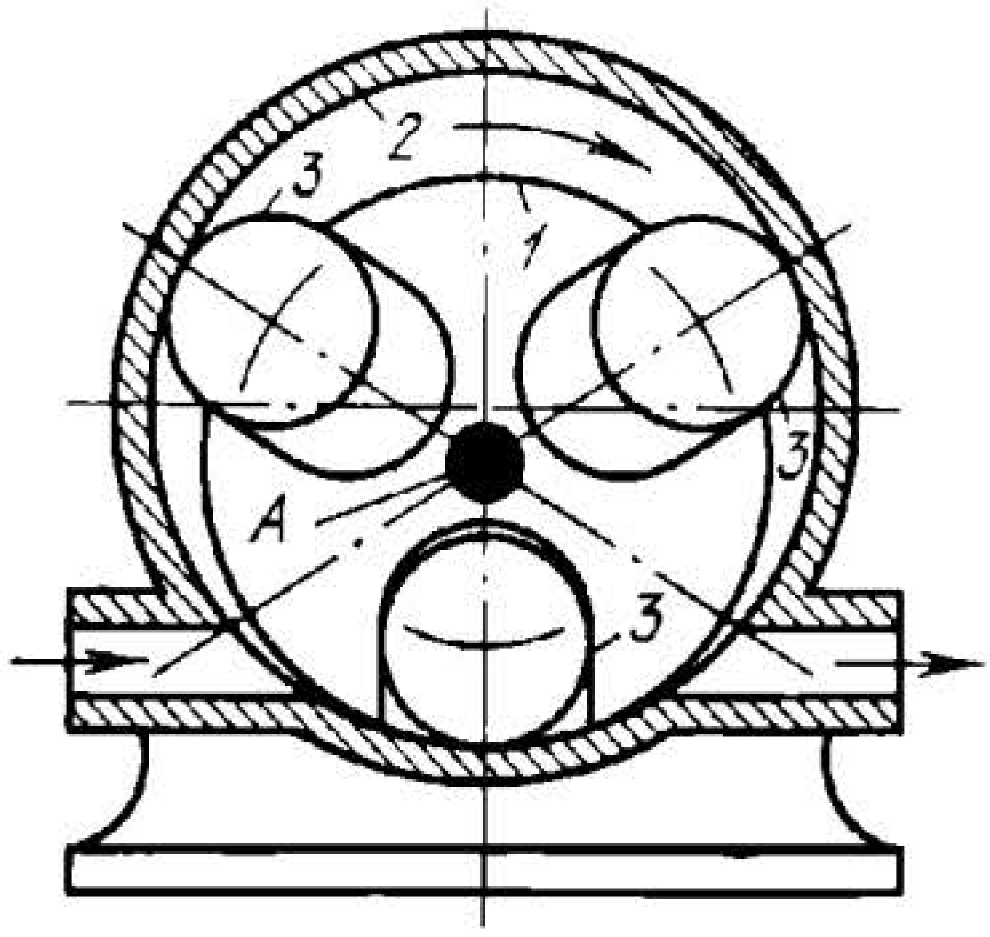


3819	LINK-GEAR MECHANISM OF AN OSCILLATING-CYLINDER PISTON PUMP	LHP RP



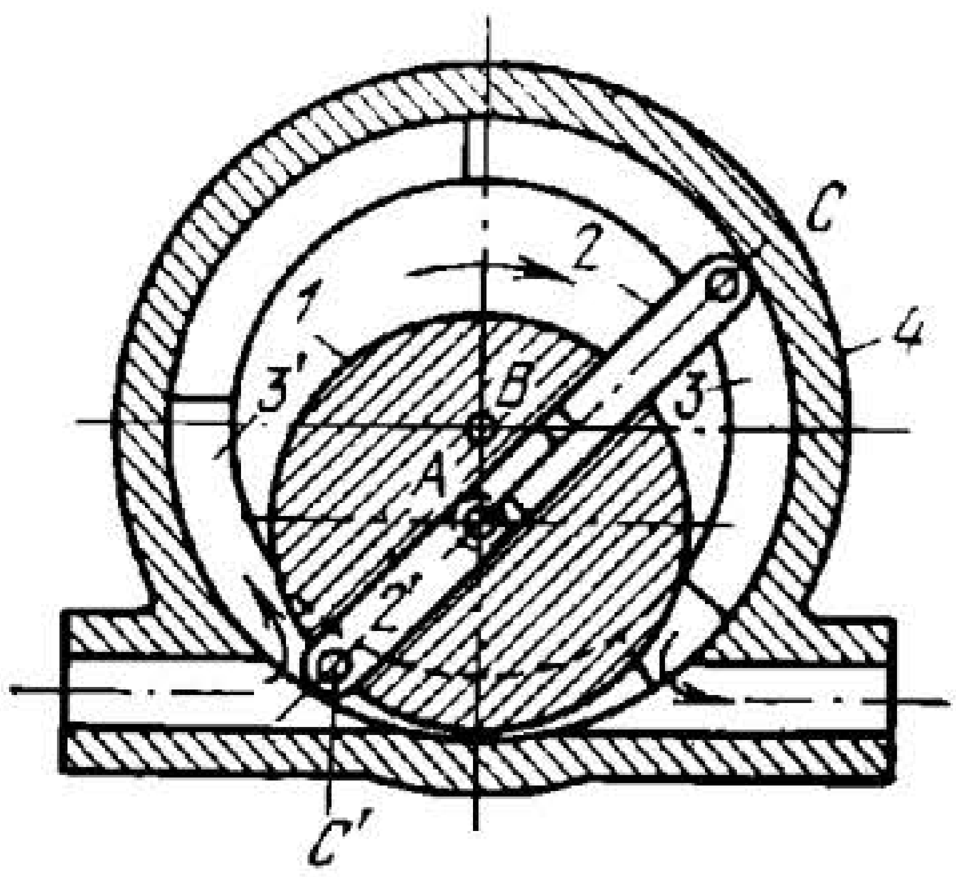
Crank *1* rotates about fixed axis *A* and is connected by turning pairs to three symmetrically arranged pistons *2* which reciprocate in bores *d* of oscillating cylinders *3*. As cylinders *3* oscillate, they open and close suction and discharge channels. The liquid is drawn into the pump through common suction inlet *a* and is discharged through outlet *b*.

3820	LINK-GEAR MECHANISM OF A ROTARY FREE-DISK-VANE PUMP	LHP RP



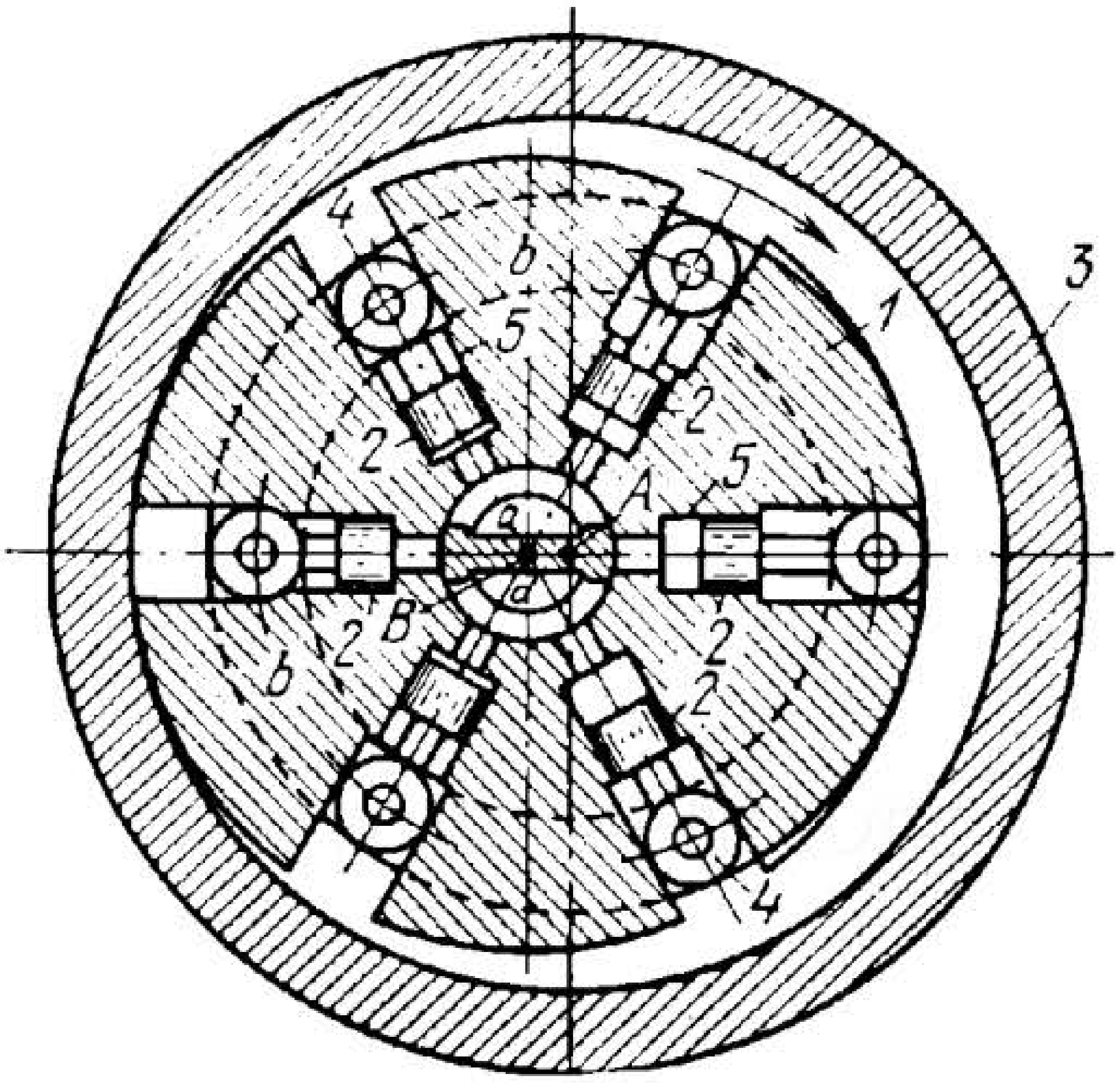
Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *2*. Rotor *1* has three symmetrical radial slots in which three cylindrical disks *3* freely slide. When rotor *1* rotates, disks *3* are held constantly against the internal surface of housing *2* by centrifugal force and deliver liquid in the direction of the arrows.

3821	FREE-VANE ROTARY PUMP MECHANISM	LHP RP



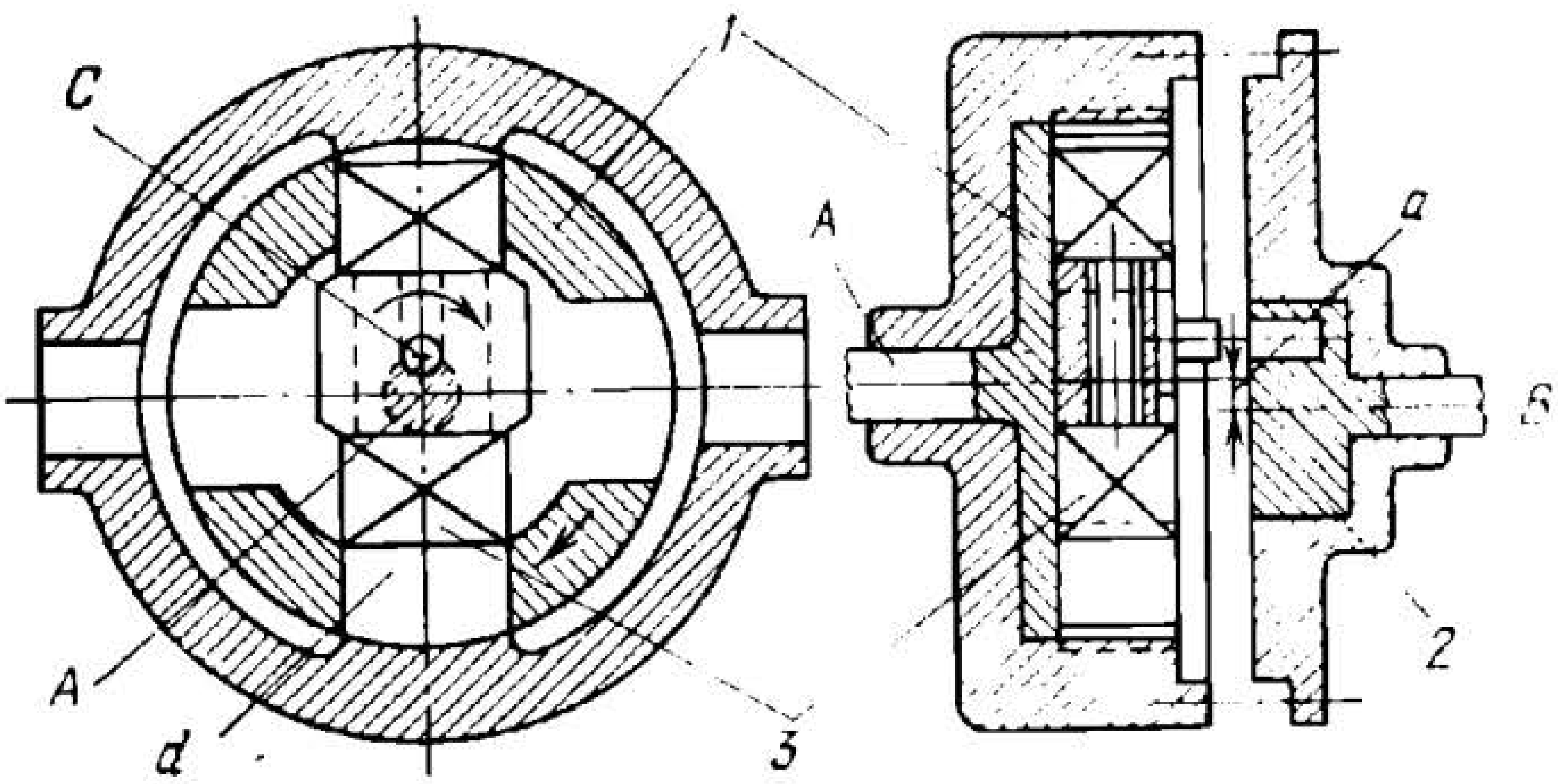
Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *4*. Rotor *1* has a slot in which vanes *2* and *2'* slide freely. Vanes *2* and *2'* are connected by turning pairs *C* and *C'* to annular sectors *3* and *3'* which slide around a slot inside housing *4*. The suction and discharge chambers are formed between vanes *2* and *2'*, housing *4* and rotor *1*.

3822	LINK-GEAR MECHANISM OF A ROTARY RADIAL-PISTON PUMP	LHP RP



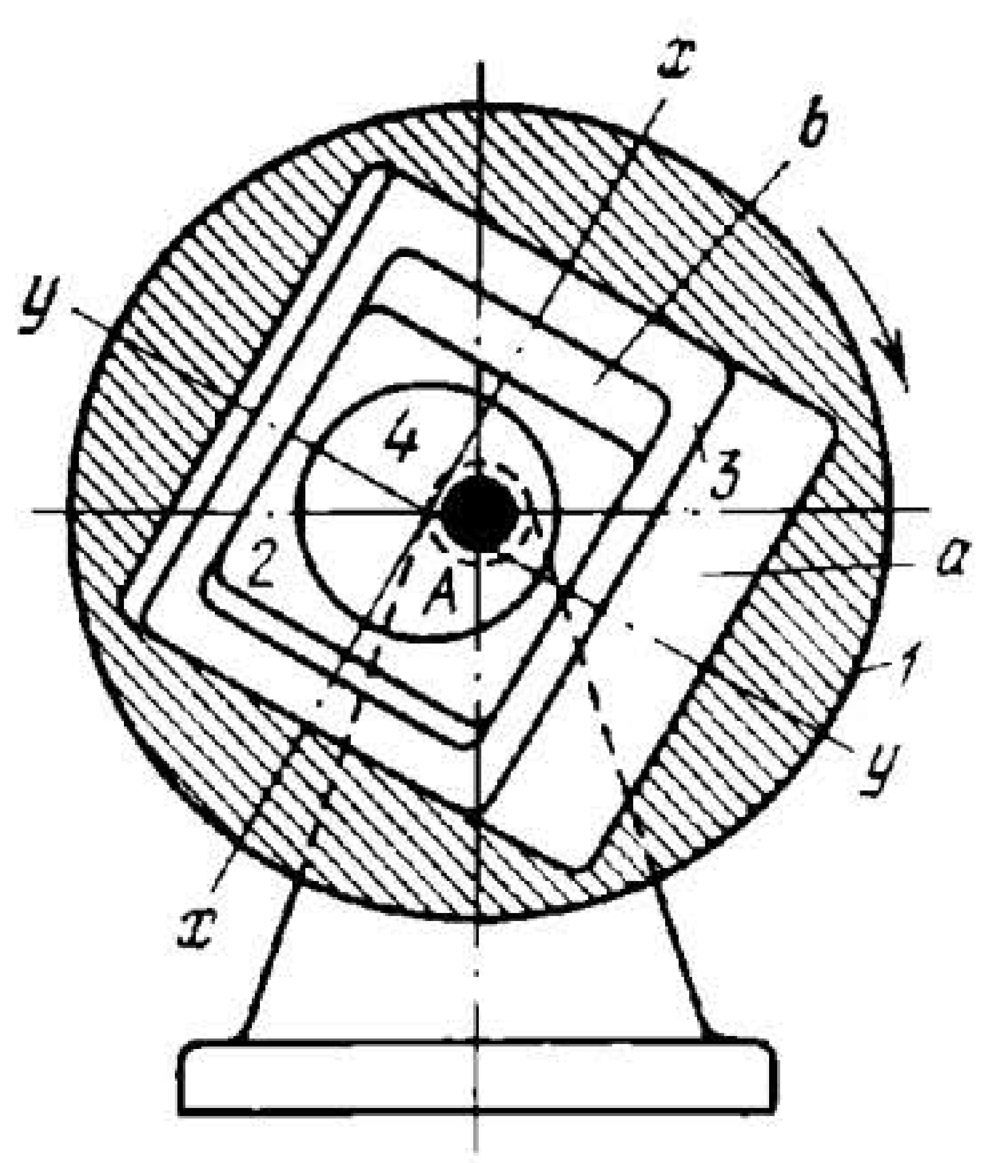
Circular rotor *1* rotates about fixed axis *B*, eccentrically located with respect to the geometric axis of housing *3*. Rotor *1* has six symmetrically arranged cylinders *5* in which pistons *2* reciprocate. Pistons *2* have rollers *4* which roll and slide in circular slot *b* having its centre at axis *A* of housing *3*. When rotor *1* rotates, the upper cylinders draw in liquid through suction input channel *a* and the lower cylinders deliver the liquid through discharge output channel *d*.

3823	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY PISTON PUMP	LHP RP



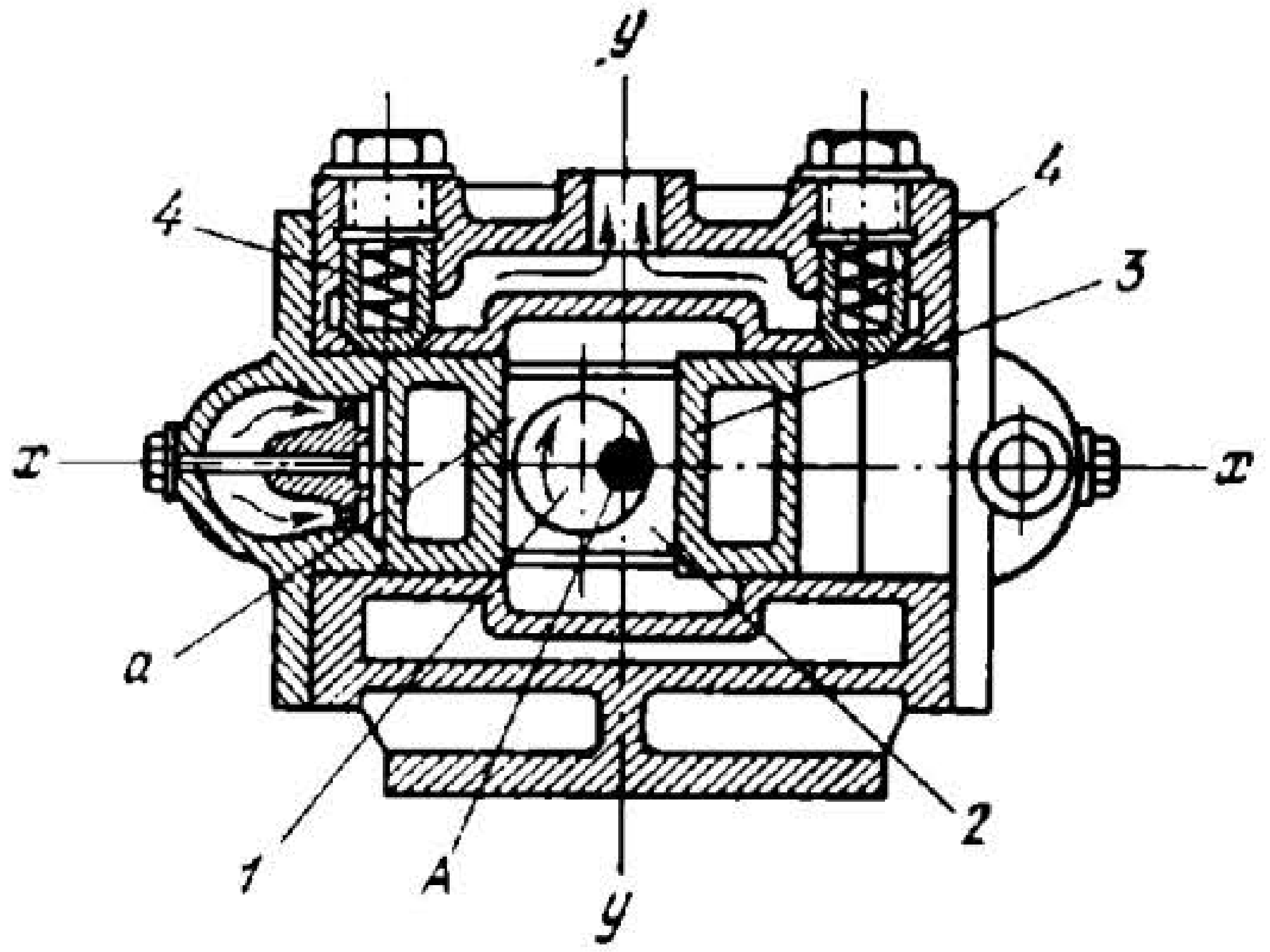
Rotor 1 rotates about fixed axis A and has cylinder d in which piston 3 reciprocates. Piston 3 is connected by turning pair C to member 2 which rotates about fixed axis B. Owing to the eccentricity a between axes A and B of links 1 and 2, when rotor 1 rotates, piston 3 reciprocates with respect to rotor 1. This motion is used to pump a liquid.

3824	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY PISTON PUMP	LHP RP



Housing 1 rotates about fixed axis A. Slider 3 reciprocates along axis y-y in guide slot a of housing 1. Piston 2 reciprocates along axis x-x of guide slot b in slider 3 and is connected by a turning pair to fixed circular eccentric cam 4. Axes x-x and y-y are at right angles. Housing 1, rotating about axis A, is also used as a pulley. This rotation reciprocates piston 2 and slider 3 along perpendicular axes. Eccentric cam 4 is rigidly secured to axis A. The motion of piston 2 is used to pump a liquid.

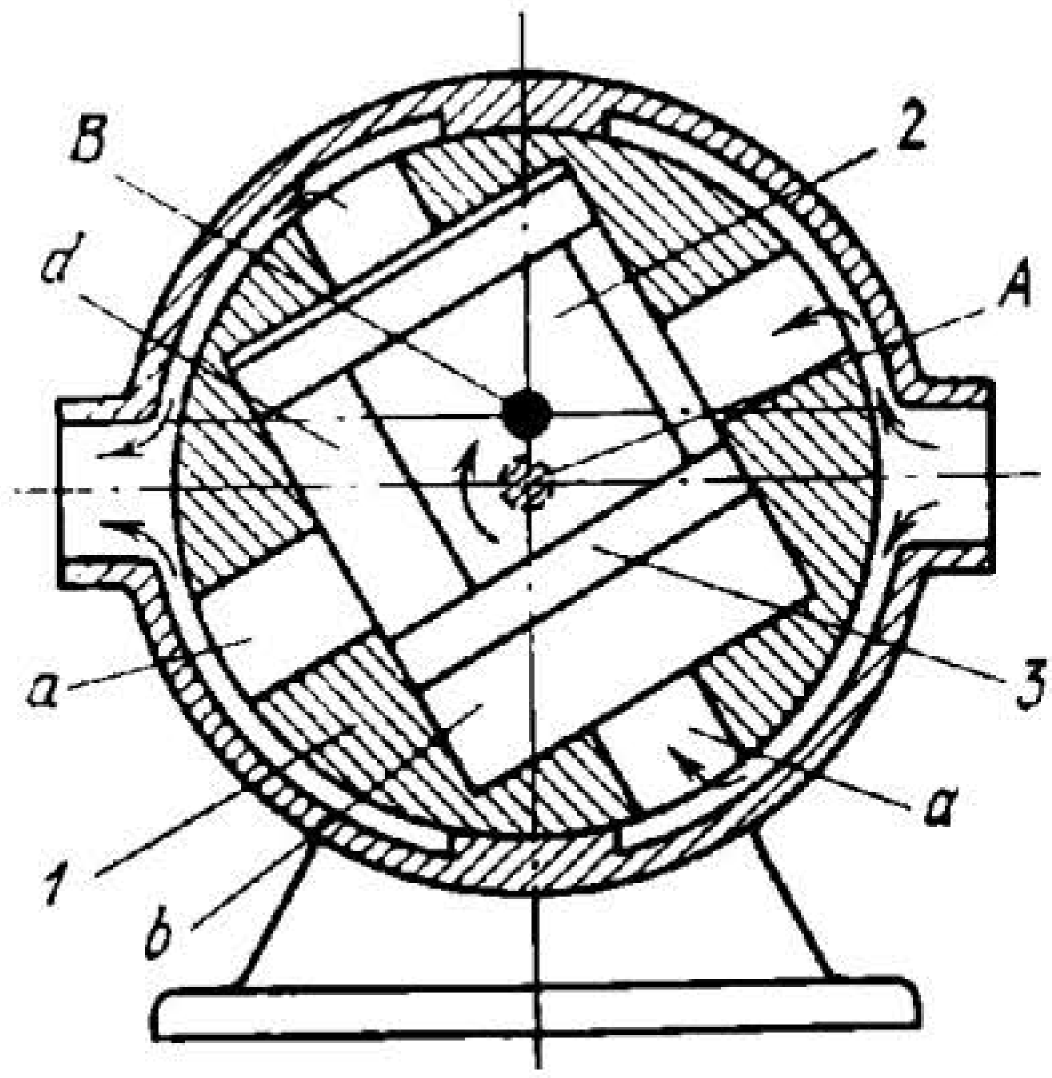
3825	LINK-GEAR ECCENTRIC MECHANISM OF A PISTON PUMP	LHP RP



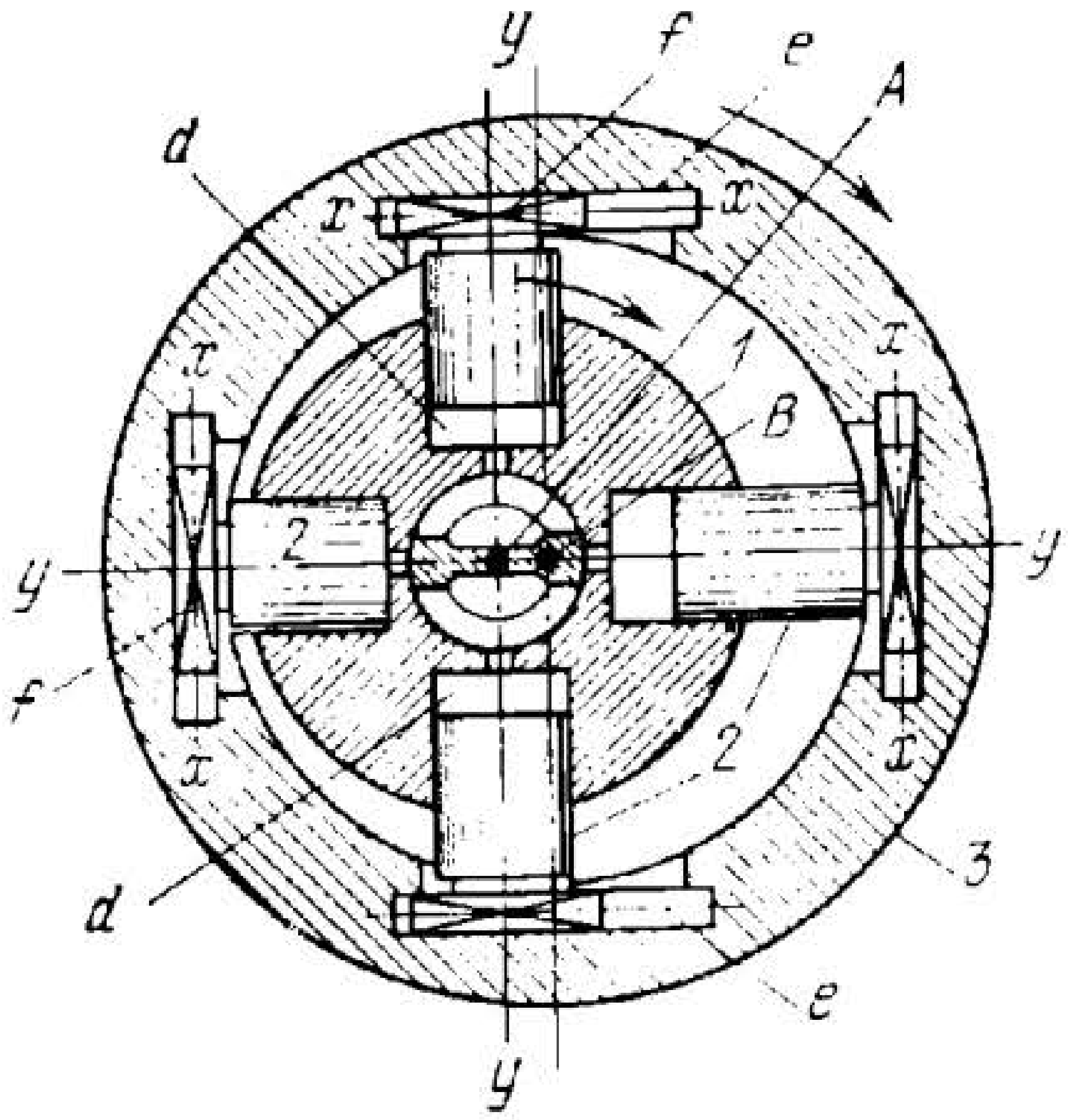
Circular eccentric 1 rotates about fixed axis A and is connected by a turning pair to slider 2 which reciprocates along axis y-y in straight guides of piston 3. Piston 3 reciprocates along axis x-x with harmonic motion. When eccentric 1 rotates, liquid is delivered in the direction of the arrows, passing through valves 4.

3826	LINK-GEAR MECHANISM OF A TWO-CYLINDER ROTARY PISTON PUMP	LHP RP

Circular rotor 1 rotates about fixed axis A and has four symmetrically arranged ports a. Piston 3 reciprocates in cylinder b of rotor 1. Piston 3 has cylinder d sliding along piston 2 which rotates about fixed axis B. When rotor 1 rotates, pistons 2 and 3 deliver liquid in the direction of the arrows.

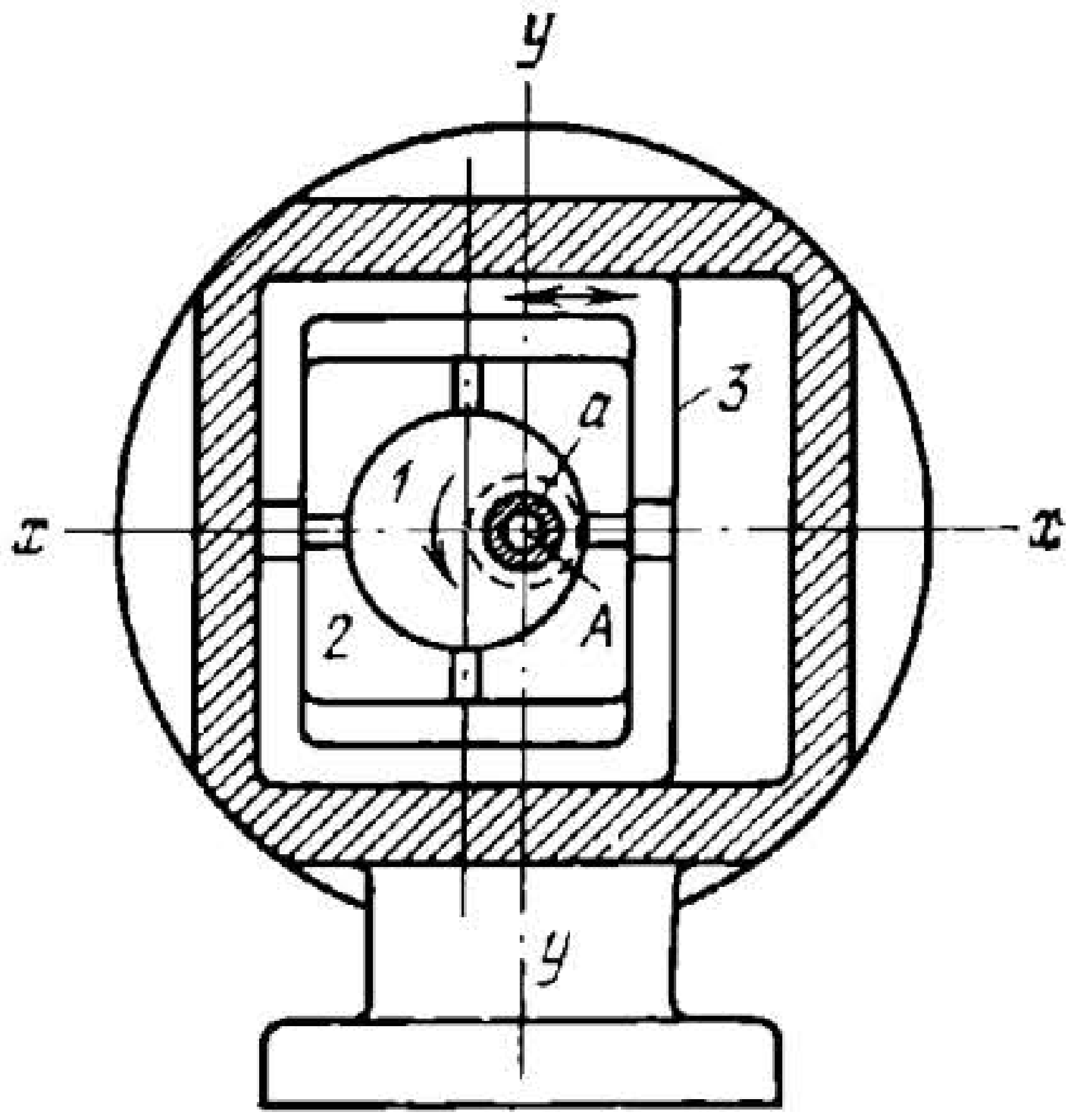


3827	LINK-GEAR MECHANISM OF THE OILGEAR ROTARY RADIAL PISTON PUMP	LHP RP



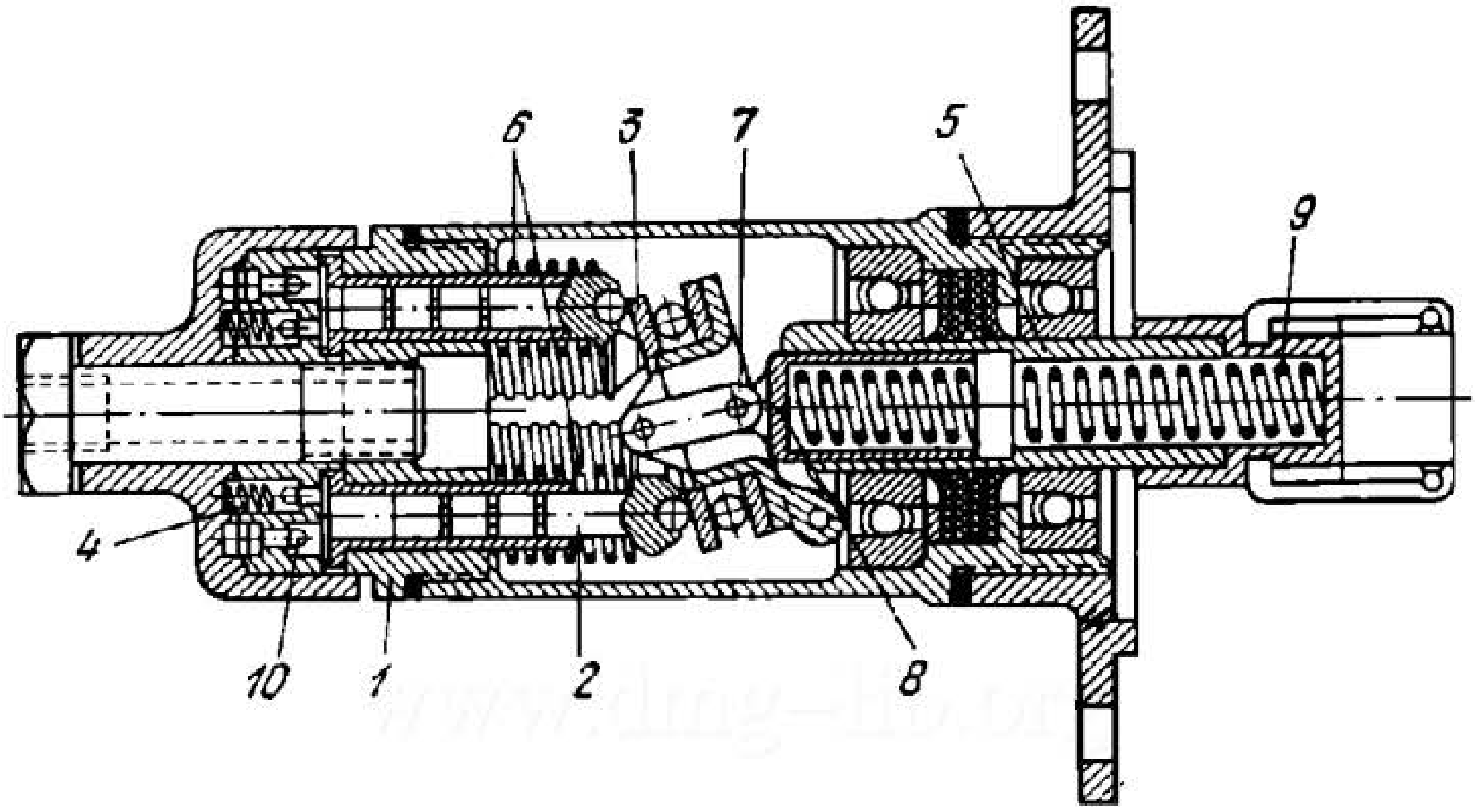
Rotor *1* rotates about fixed axis *A* and has four symmetrically arranged cylinders *d* in which pistons *2* reciprocate. Pistons *2* have at their ends sliders *f* which reciprocate in guide slots *e* of drum *3*. Drum *3* rotates about fixed axis *B*, eccentrically located with respect to axis *A*. When rotor *1* and drum *3* rotate, pistons *2* reciprocate along axes *y-y* and sliders *f* along axes *x-x*, delivering liquid from the suction to the discharge channels.

3828	LINK-GEAR ECCENTRIC MECHANISM OF A HOLLOW-SHAFT PISTON PUMP	LHP RP



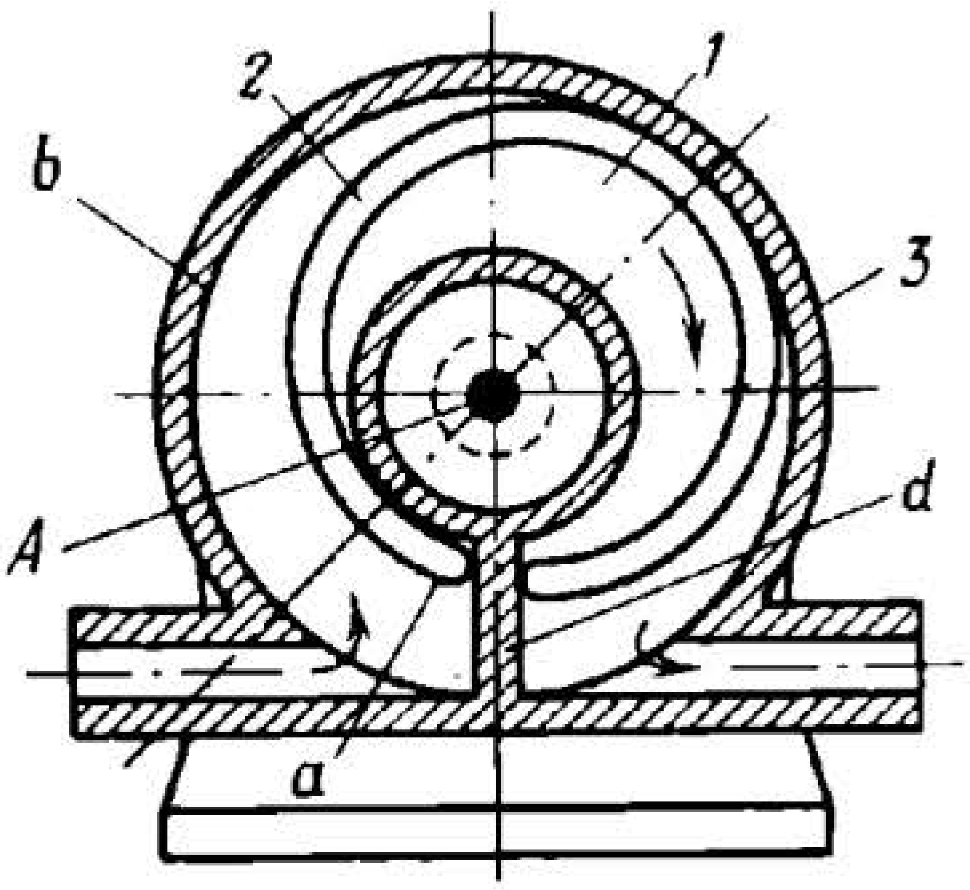
Circular eccentric *1* rotates about fixed axis *A* together with hollow shaft *a* and is connected by a turning pair to slider *2* which reciprocates along axis *y-y* in a guide slot of piston *3*. Piston *3* reciprocates along axis *x-x* and its motion is used to pump a liquid. The hollow shaft serves as a pipeline.

3829	MECHANISM OF A ROTARY SWASH-PLATE AXIAL PISTON PUMP	LHP RP



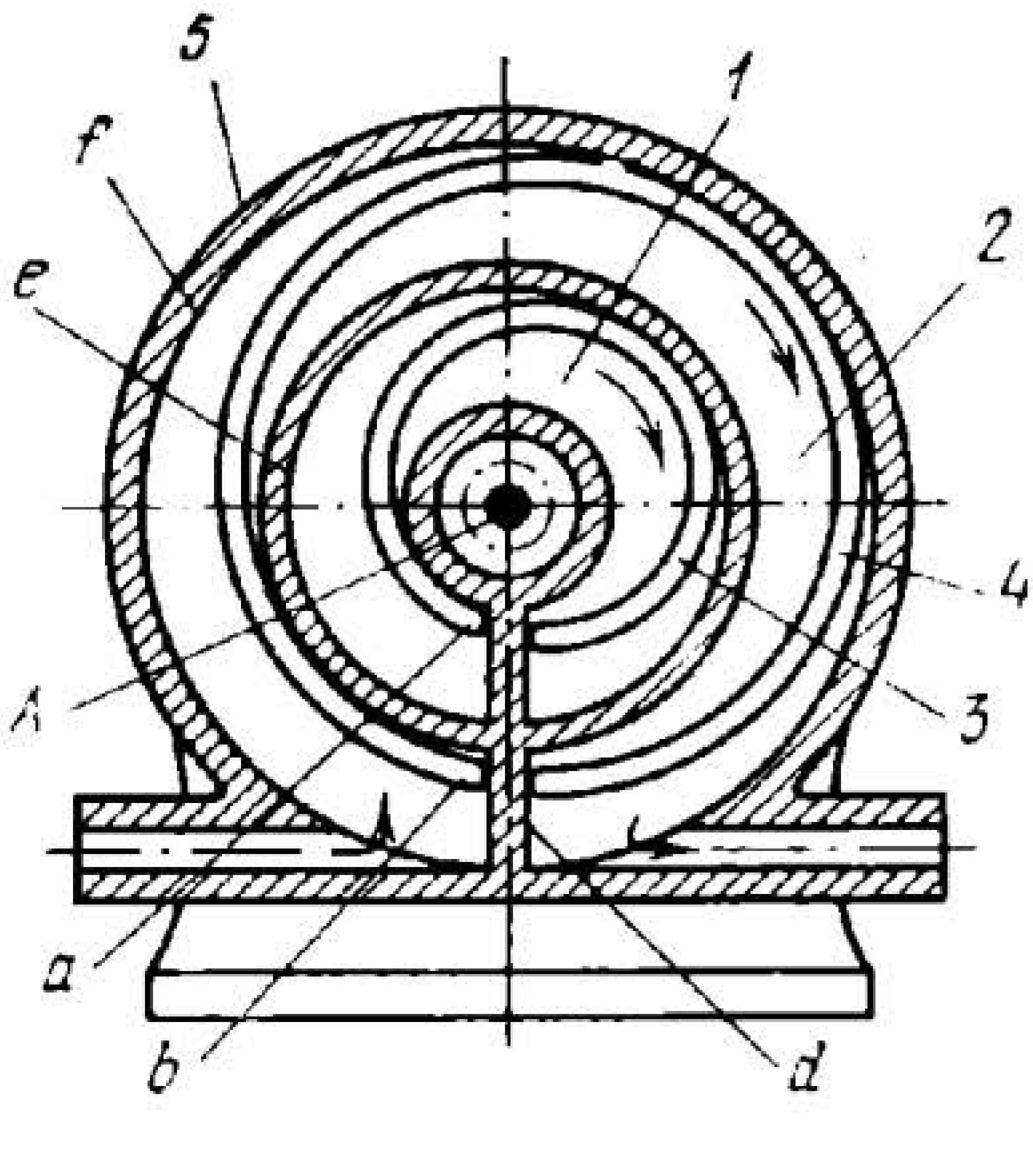
Stationary cylinder block *1* contains pistons *2* reciprocated by the driving swash plate *3* to which they are held by springs *6*. Liquid is drawn in through ball valve *10* and discharged through ball valve *4*. The body of the swash plate is hinged to drive shaft *5* and, by means of link *7*, to sleeve *8* of pressure spring *9*. In its rotation shaft *5* drives the body of the swash plate and spring *9* holds the body in the inclined position. As the pressure increases in the discharge line, plate *3* approaches its vertical position (perpendicular to the axis of the pump) and the pump delivery is reduced.

3830	LINK-GEAR ECCENTRIC MECHANISM OF A SPLIT-COLLAR ROTARY PUMP	LHP RP



Circular rotor 1 rotates about eccentrically located axis A, coinciding with the geometric axis of housing 3. Rotor 1 is encircled by split collar 2 whose rounded ends a slide along fixed partition d of housing 3. When rotor 1 rotates, collar 2 slides along internal surface b of housing 3 and delivers liquid in the direction of the arrows.

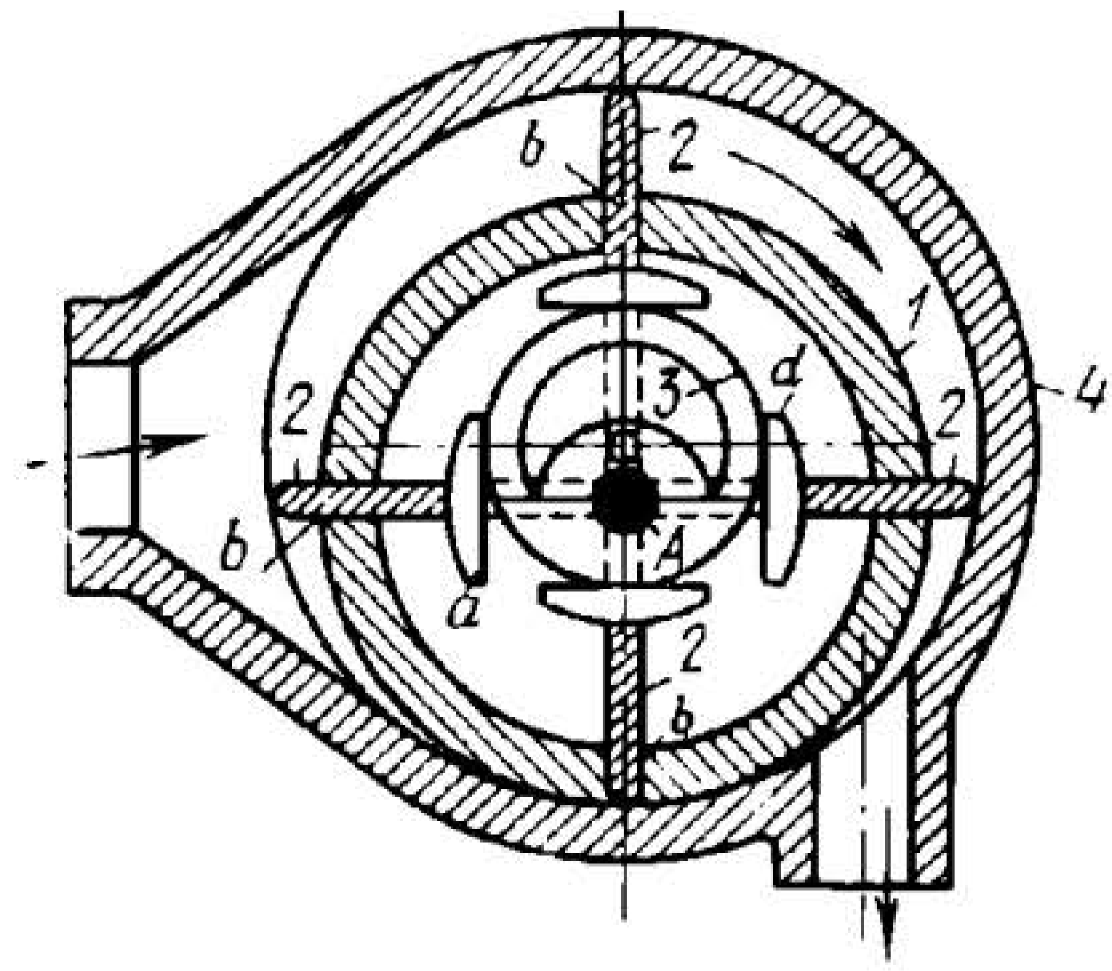
3831	LINK-GEAR ECCENTRIC MECHANISM OF A DOUBLE-ROTOR SPLIT-COLLAR ROTARY PUMP	LHP RP



Rigidly attached to each other, circular rotors 1 and 2 rotate about eccentrically located fixed axis A, coinciding with the geometric axis of housing 5. Rotors 1 and 2 are encircled by split collars 3 and 4 whose rounded ends a and b slide along fixed partition d of housing 5. When rotors 1 and 2 rotate, collars 3 and 4 slide along internal surfaces e and f of housing 5 and deliver liquid in the direction of the arrows. The chamber inside surface e of the housing is connected by channels (not shown) with the input and discharge channels.

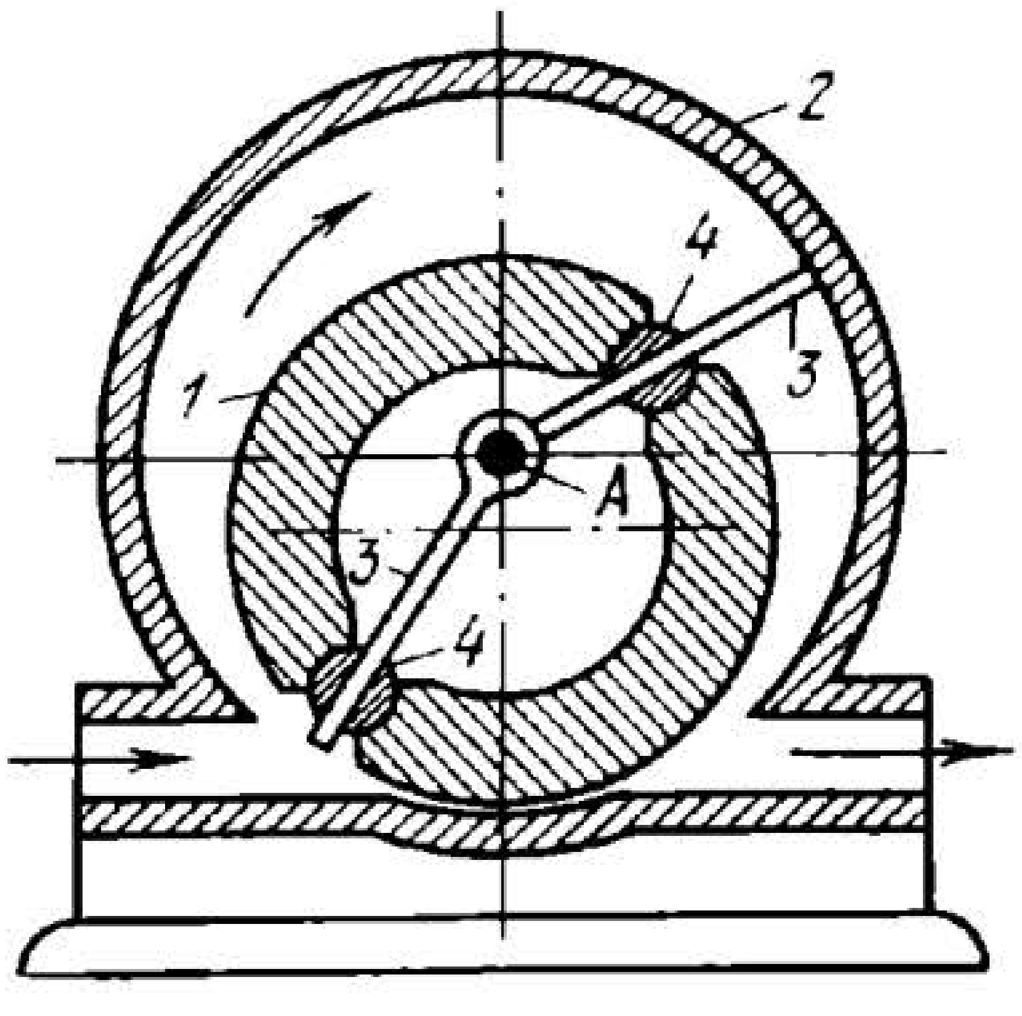
3832	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY VANE COMPRESSOR WITH A STATIONARY ECCENTRIC	LHP RP

Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *4*. Vanes *2*, having flat heads *a* at one end, reciprocate in guide slots *b* of rotor *1*. When rotor *1* rotates, heads *a* of vanes *2* slide along stationary circular eccentric *3* and deliver the fluid (liquid or gas) in the direction of the arrows. The suction and discharge chambers are formed between vanes *2*, housing *4* and rotor *1*.

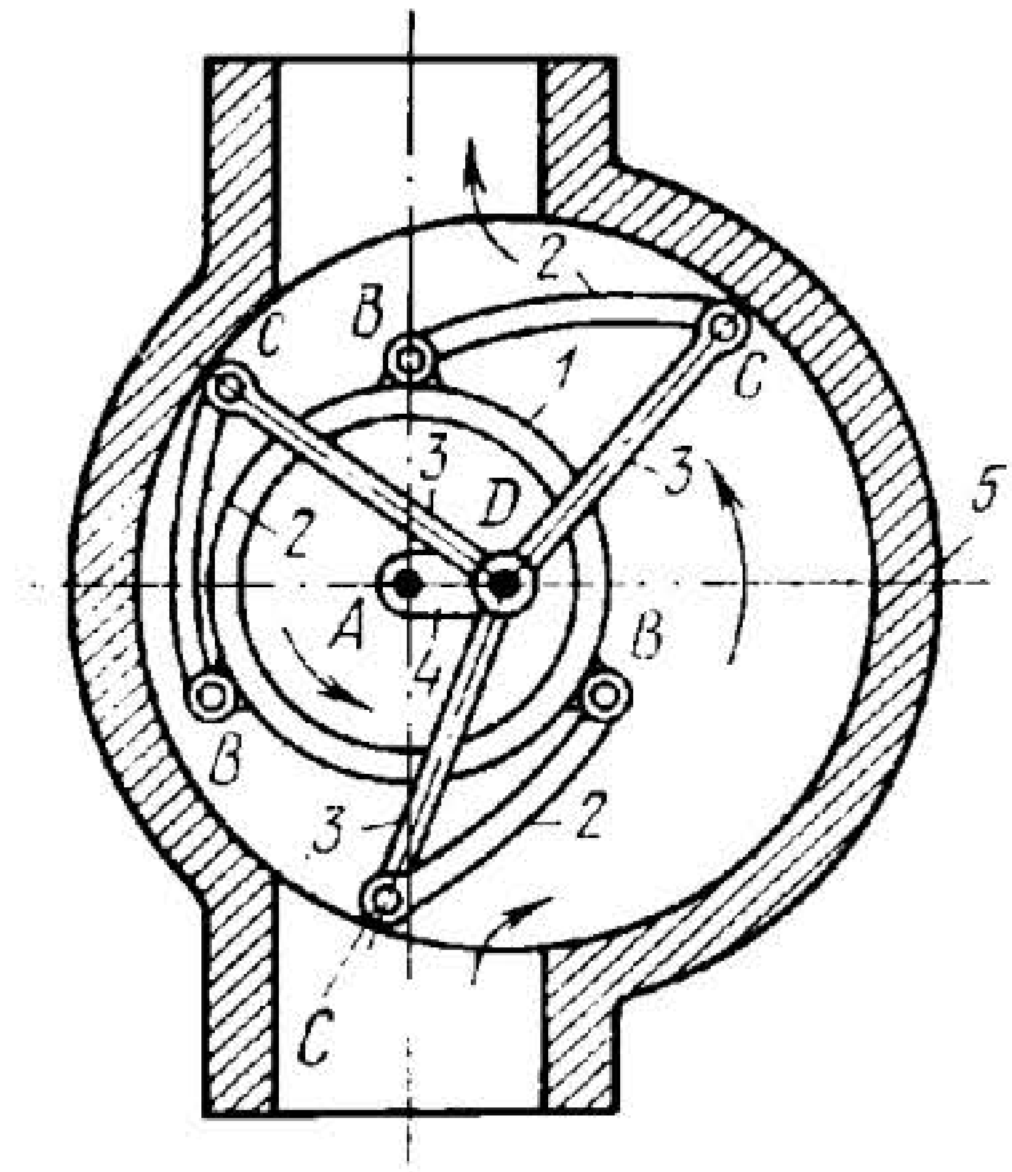


3833	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY VANE PUMP	LHP RP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *2*. Vanes *3* rotate about axis *A* and slide in bearing members *4* which are connected by turning pairs to rotor *1*. When rotor *1* rotates, vanes *3* deliver liquid in the direction of the arrows.

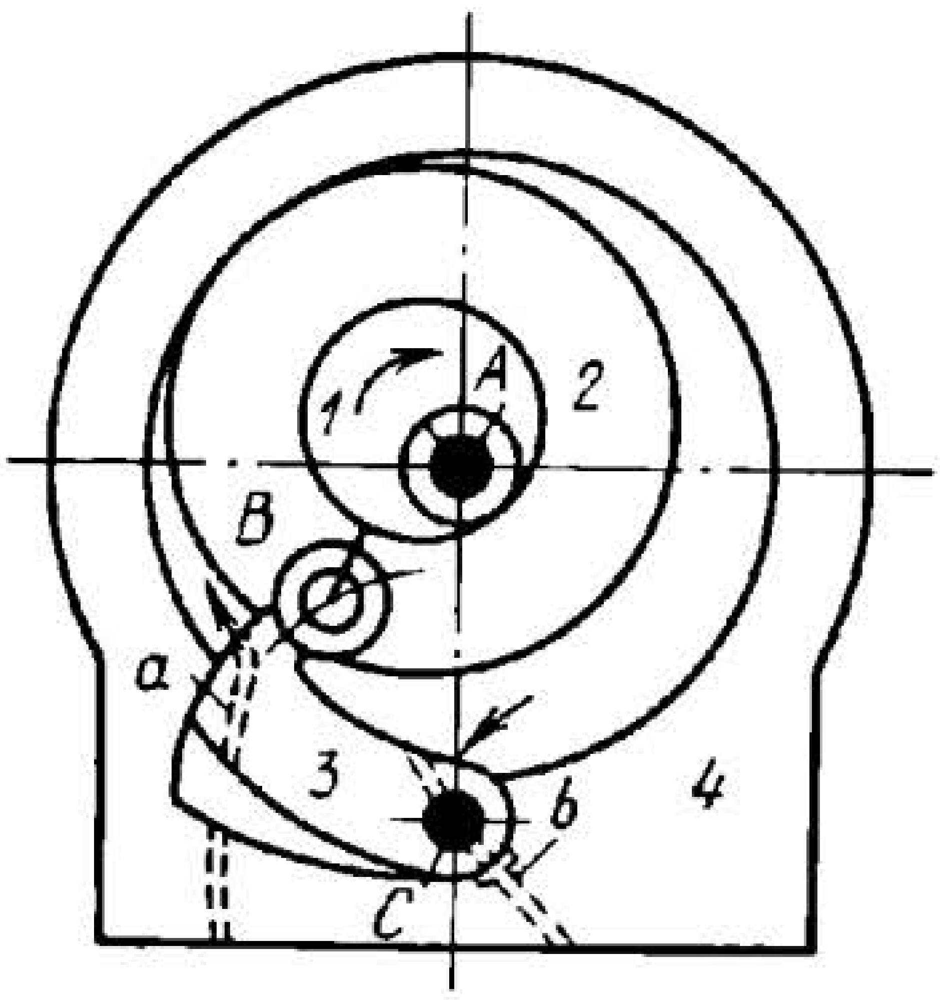


3834	LINKWORK MECHANISM OF A TRIPLE VANE ROTARY PUMP	LHP RP



Circular rotor *1* rotates about fixed axis *A*, eccentrically located with respect to the geometric axis of housing *5*. Three vanes *3* rotate about fixed axis *D*, coinciding with the geometric axis of housing *5*. Links *2* are connected by turning pairs *B* and *C* to rotor *1* and vanes *3*. When rotor *1* rotates, vanes *3* deliver liquid in the direction of the arrows, sliding with their ends along the internal surface of housing *5*.

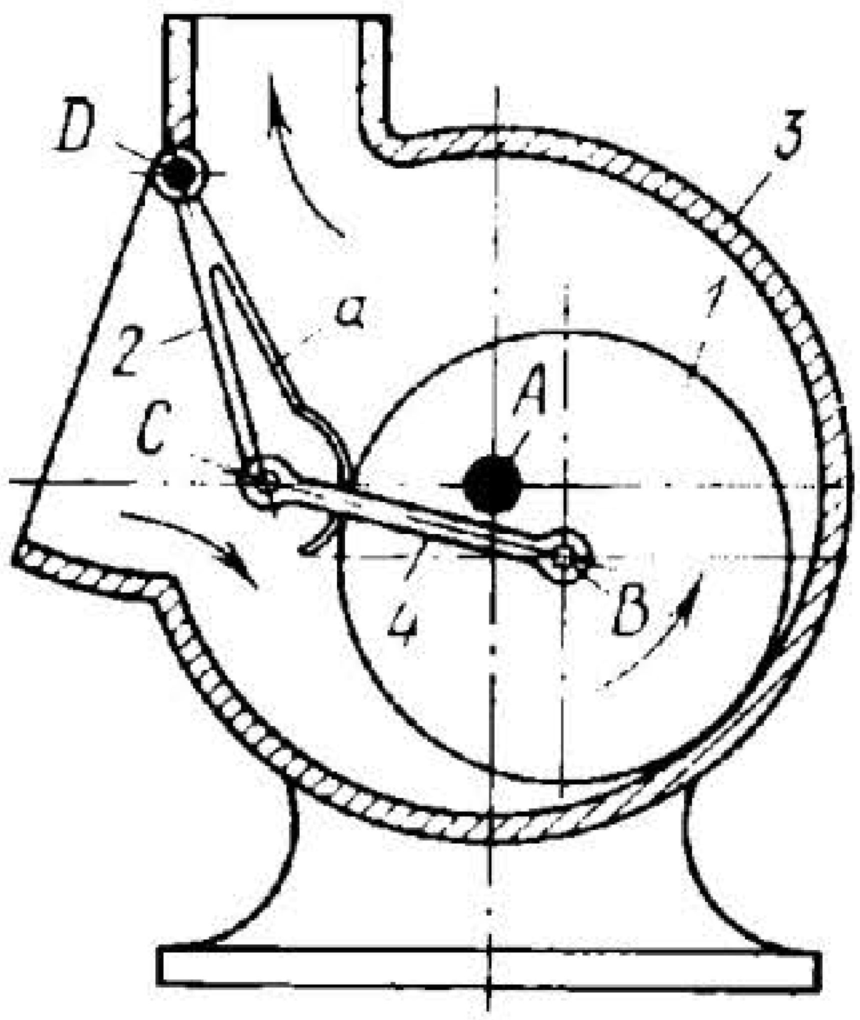
3835	LEVER-ECCENTRIC MECHANISM OF A ROTARY COLLAR PUMP	LHP RP



Circular eccentric *1* rotates about fixed axis *A*, coinciding with the geometric axis of housing *4*. Eccentric *1* is encircled by collar *2* which slides along the internal surface of housing *4*. Collar *2* is connected by turning pair *B* to abutment member *3* which separates the suction and discharge chambers and oscillates about fixed axis *C*. Member *3* has liquid input channel *a* and discharge channel *b*. When eccentric *1* rotates, liquid is delivered from channel *a* to channel *b*.

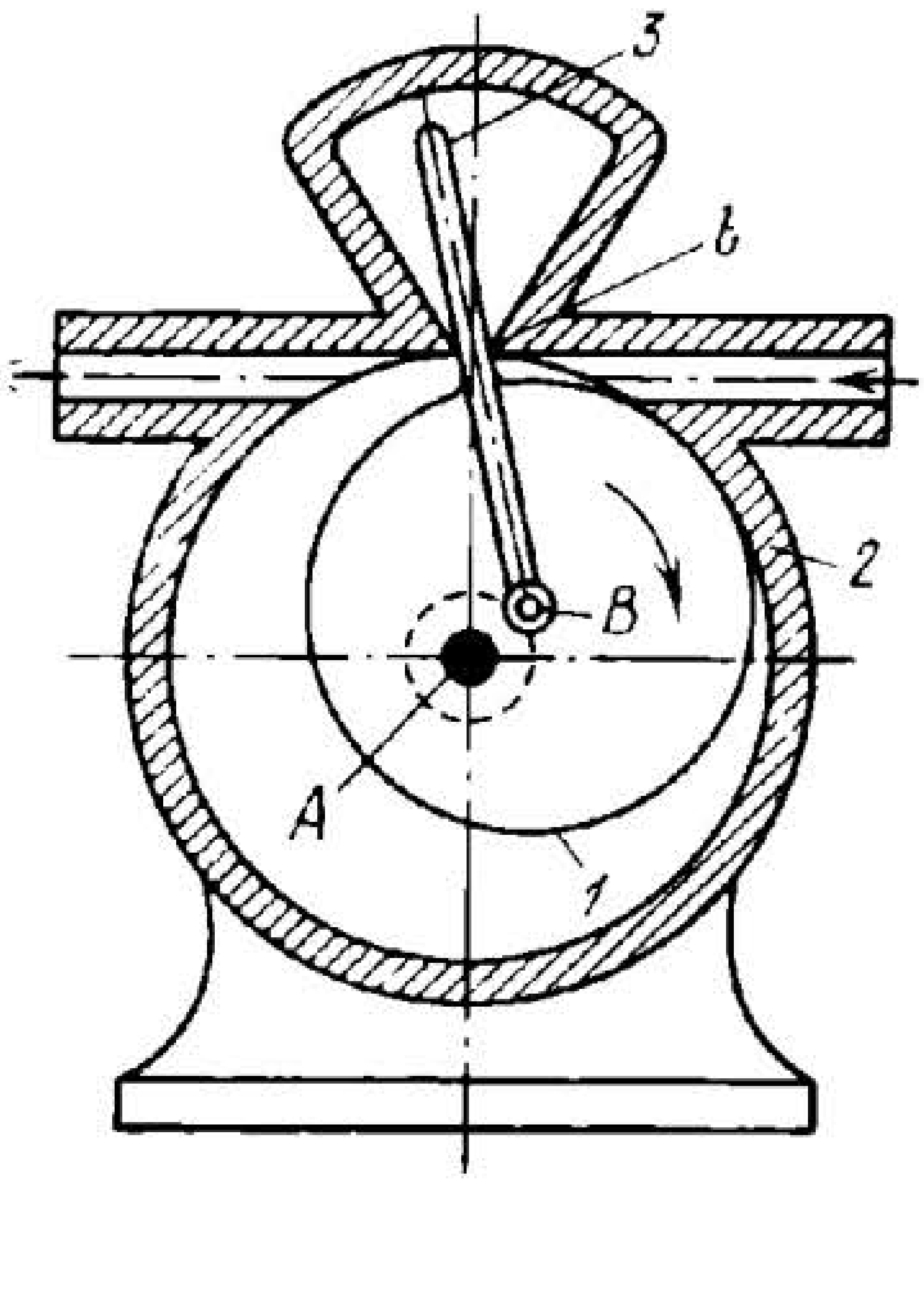
3836	LEVER-ECCENTRIC MECHANISM OF A ROTARY PUMP	LHP RP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *3*. Rotor *1* slides along the internal surface of housing *3*. Connecting rod *4* is connected by turning pairs *B* and *C* to rotor *1* and to rocker arm *2* which oscillates about fixed axis *D*. When rotor *1* rotates, liquid is delivered in the direction of the arrows. The suction and discharge chambers are separated by abutment *a* which is rigidly attached to rocker arm *2*.

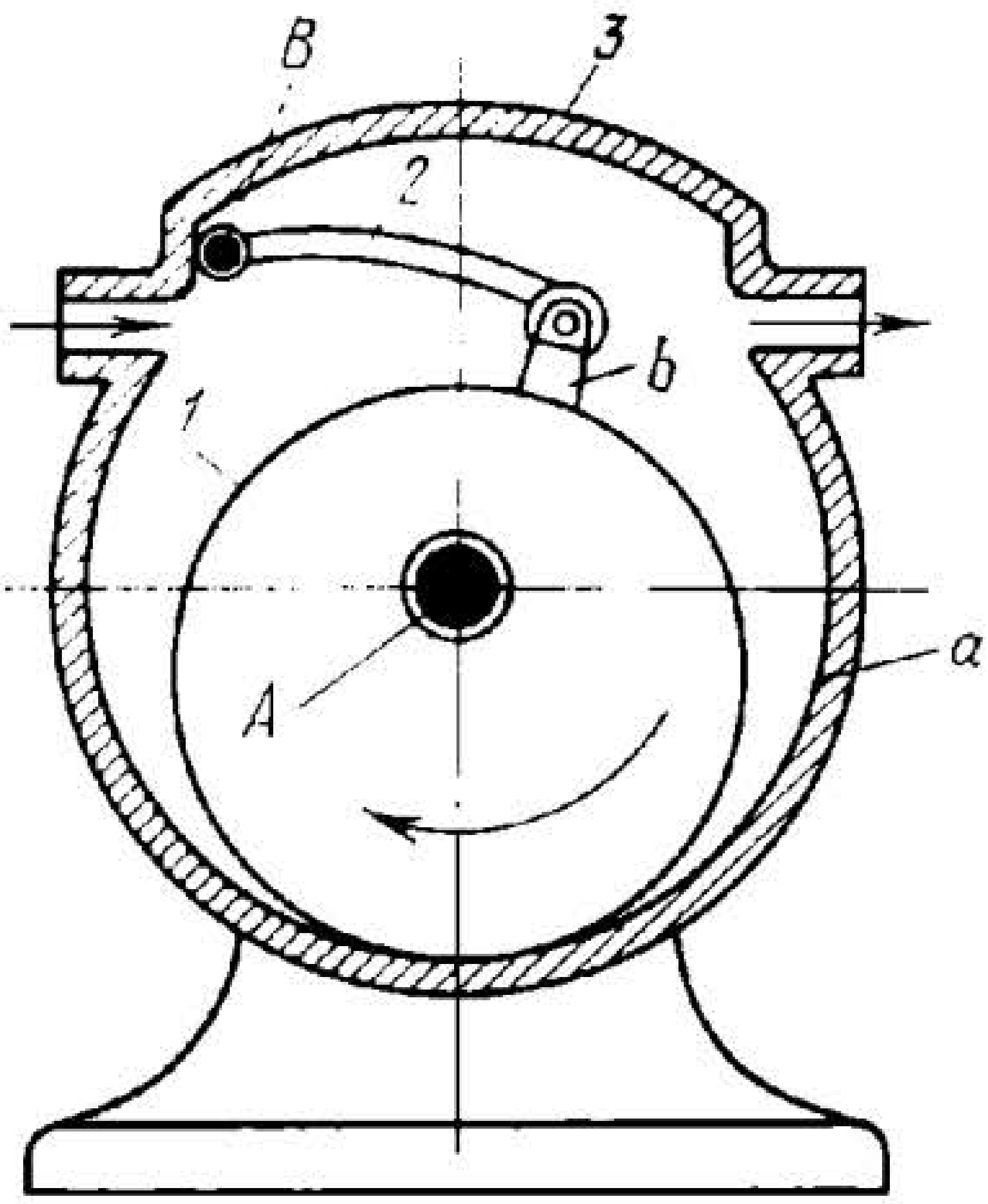


3837	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY PUMP	LHP RP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *2*. Rotor *1* slides along the internal surface of housing *2*. Vane *3* is connected by turning pair *B* to rotor *1* and slides in angular guides *b* of housing *2*. When rotor *1* rotates, liquid is delivered in the direction of the arrows. Vane *3* of the rotor serves to separate the suction and discharge chambers.

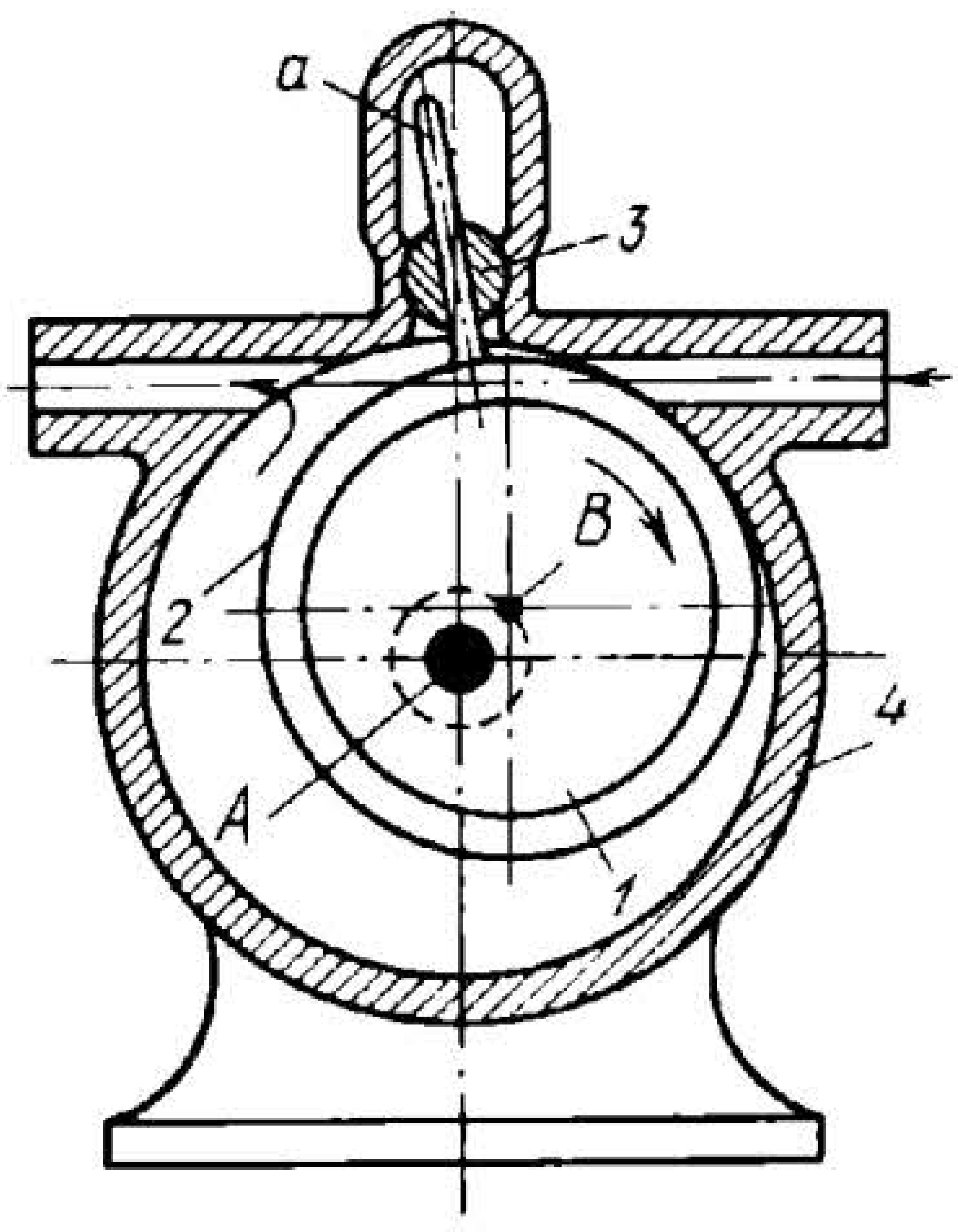


3838	LEVER-ECCENTRIC MECHANISM OF A HINGED-ABUTMENT ROTARY PUMP	LHP RP



Circular rotor 1 rotates about eccentrically located fixed axis A, coinciding with the geometric axis of housing 3. Rotor 1 slides along the internal surface a of housing 3 and delivers liquid in the direction of the arrows. Abutment 2 turns about fixed axis B and its head b, held against rotor 1 by gravity or a spring (not shown), serves to separate the suction and discharge chambers.

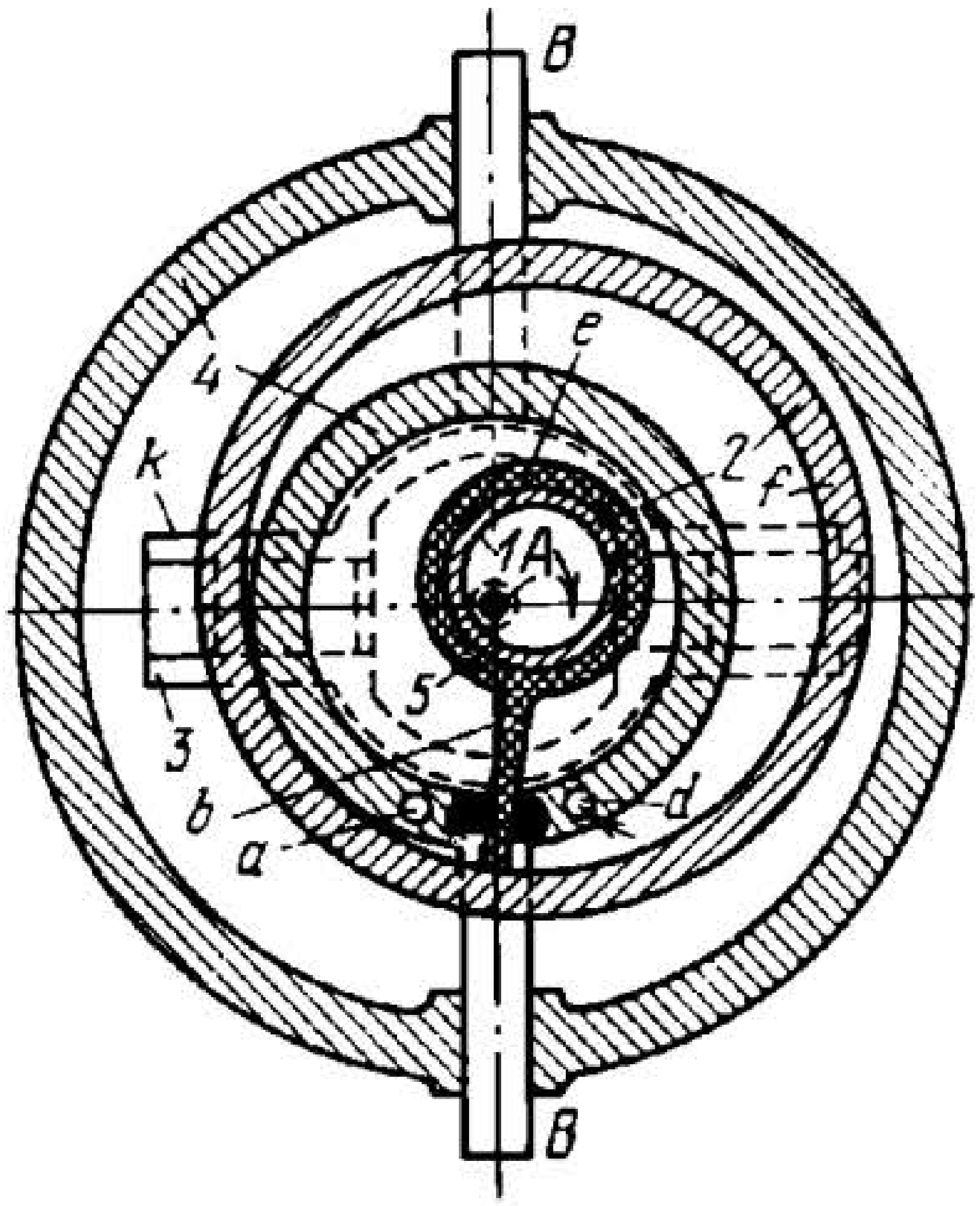
3839	LINK-GEAR ECCENTRIC MECHANISM OF A COLLAR-TYPE ROTARY PUMP	LHP RP



Circular rotor 1 rotates about eccentrically located fixed axis A, coinciding with the geometric axis of housing 4. Rotor 1 is encircled by collar 2, having vane a which slides in bearing member 3. Member 3 is connected by a turning pair to housing 4. When rotor 1 rotates, liquid is delivered in the direction of the arrows. Vane a of collar 2 separates the suction and discharge chambers.

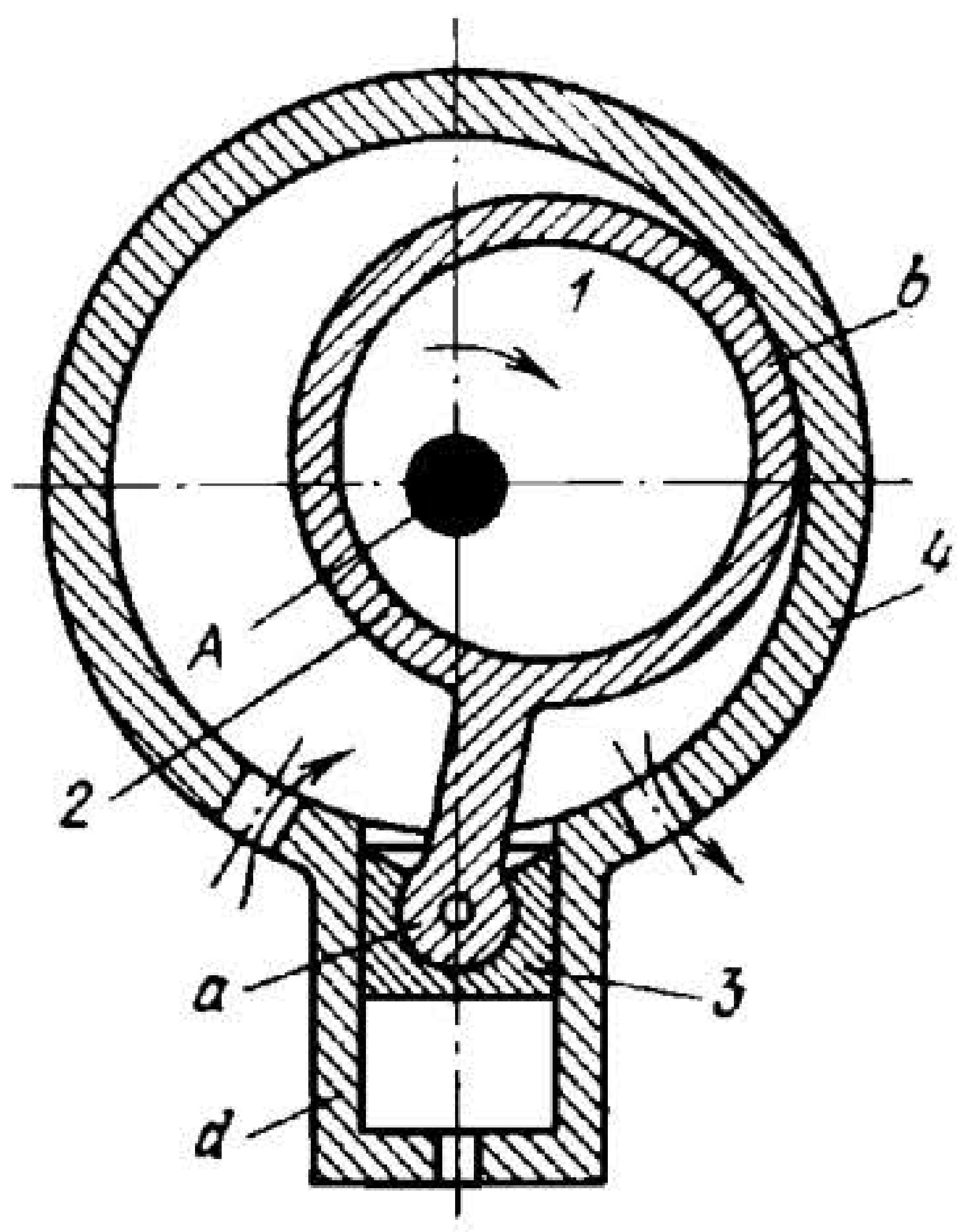
3840	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY PUMP	LHP RP

Circular eccentric 1 rotates about fixed axis A and is connected by a turning pair to sleeve e of link 2. Rigidly attached to sleeve e is concentric sleeve f. Link 2 reciprocates along straight guide slot k of crosshead 3 which is connected by sliding pairs B to fixed housing 4. When eccentric 1 rotates, sleeve f rolls and slides around sleeve 4 which is part of the fixed housing. This pumps the liquid through channels a and d. Collar 5 with shank b separates the suction and discharge chambers.

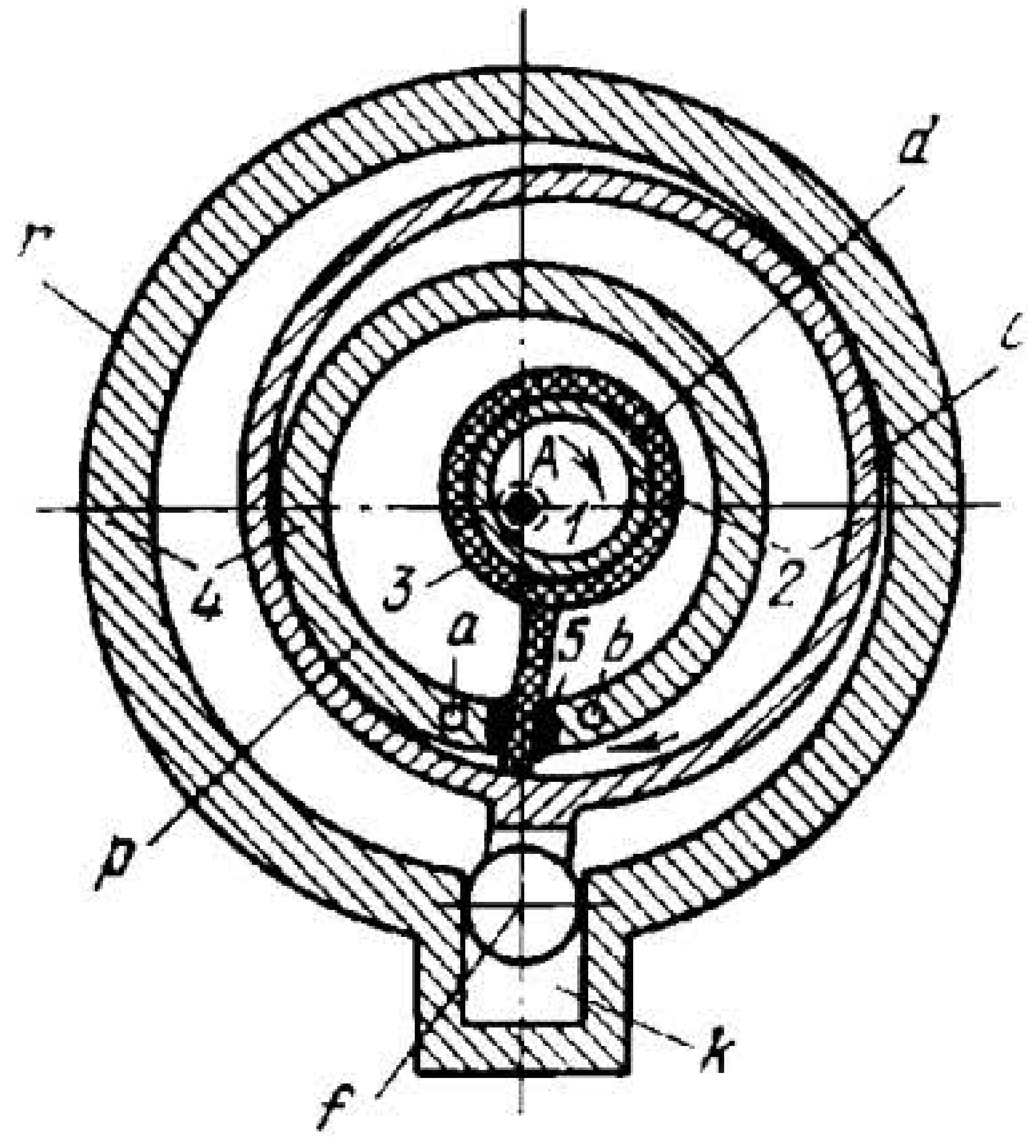


3841	SLIDER-CRANK MECHANISM OF A COLLAR-TYPE ROTARY PUMP	LHP RP

Circular eccentric 1 rotates about fixed axis A, coinciding with the geometric axis of housing 4, and is connected by a turning pair to connecting rod 2 whose collar b encircles eccentric 1. Connecting rod 2 has head a which is connected by a turning pair to slider 3, reciprocating in fixed guides d. When eccentric 1 rotates, collar b slides along the internal surface of housing 4, delivering liquid in the direction of the arrows.

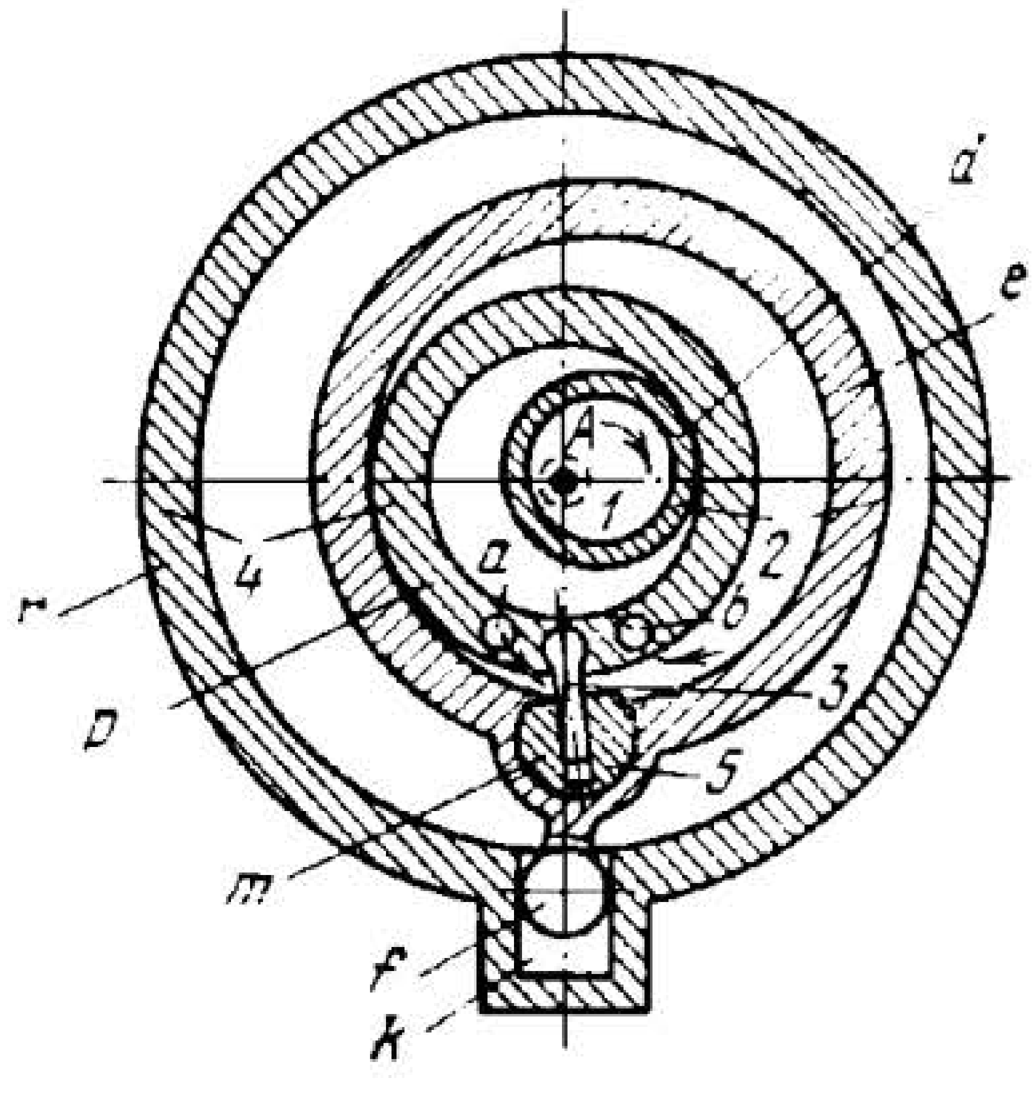


3842	SLIDER-CRANK MECHANISM OF A ROTARY PUMP	LHP RP



Circular eccentric *1* rotates about fixed axis *A* and is connected by a turning pair to sleeve *d* of link *2*. Rigidly attached to sleeve *d* is concentric sleeve *e* which has head *f* sliding in fixed guide slot *k* of housing *4*. When eccentric *1* rotates, sleeve *e* rolls and slides around sleeves *p* and *r*, which are parts of fixed housing *4*. Collar *3* is connected by a turning pair to sleeve *d* and its shank is connected by a sliding pair to bearing member *5* which, in turn, is connected by a turning pair to fixed sleeve *p*. Collar *3* and its shank separate the suction and discharge chambers formed by sleeves *e*, *p* and *r*. Liquid enters and exits through channels *a* and *b*.

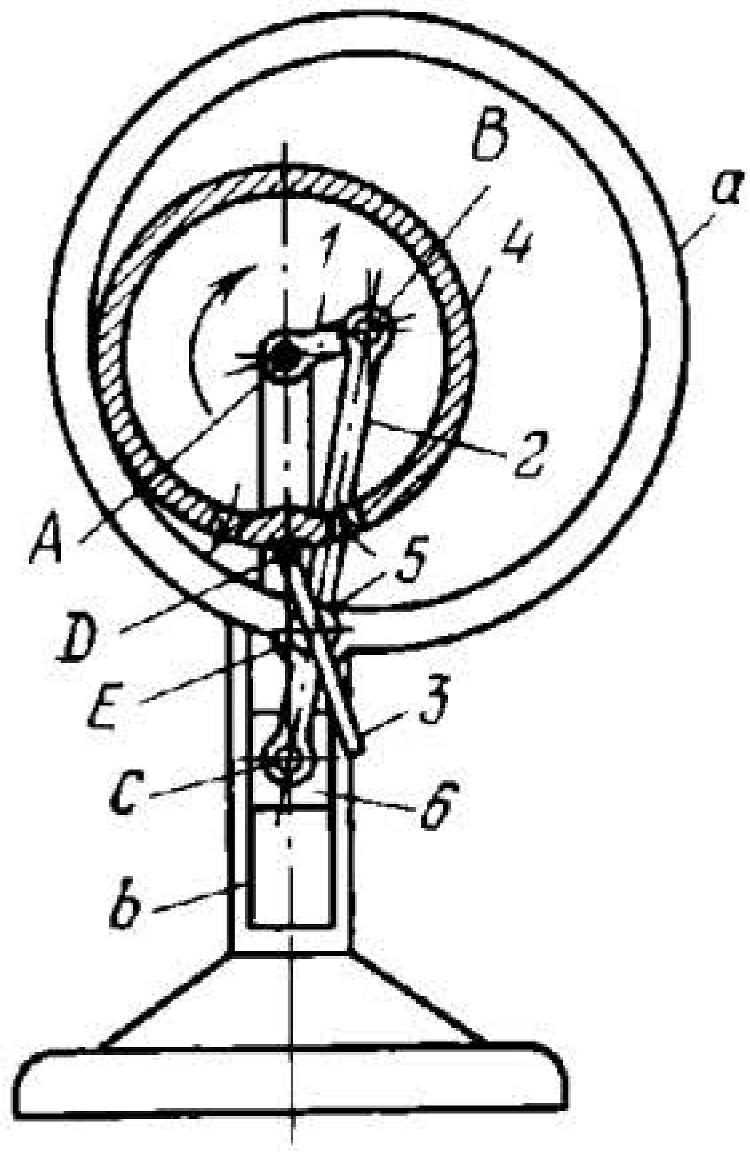
3843	SLIDER-CRANK MECHANISM OF A ROTARY PUMP	LHP RP



Circular eccentric *1* rotates about fixed axis *A* and is connected by a turning pair to sleeve *d* of link *2*. Rigidly attached to sleeve *d* is concentric sleeve *e* which has head *f* sliding in fixed guide slot *k* of housing *4*. When eccentric *1* rotates, sleeves *d* and *e* roll and slide around sleeves *p* and *r*, which are parts of housing *4*. Link *3* is connected by a turning pair to sleeve *p* and its shank *m* is connected by a sliding pair to bearing member *5* which, in turn, is connected by a turning pair to sleeve *e*. Link *3* and its shank separate the suction and discharge chambers formed by sleeves *d*, *e*, *p* and *r*. Liquid enters and exits through channels *a* and *b*.

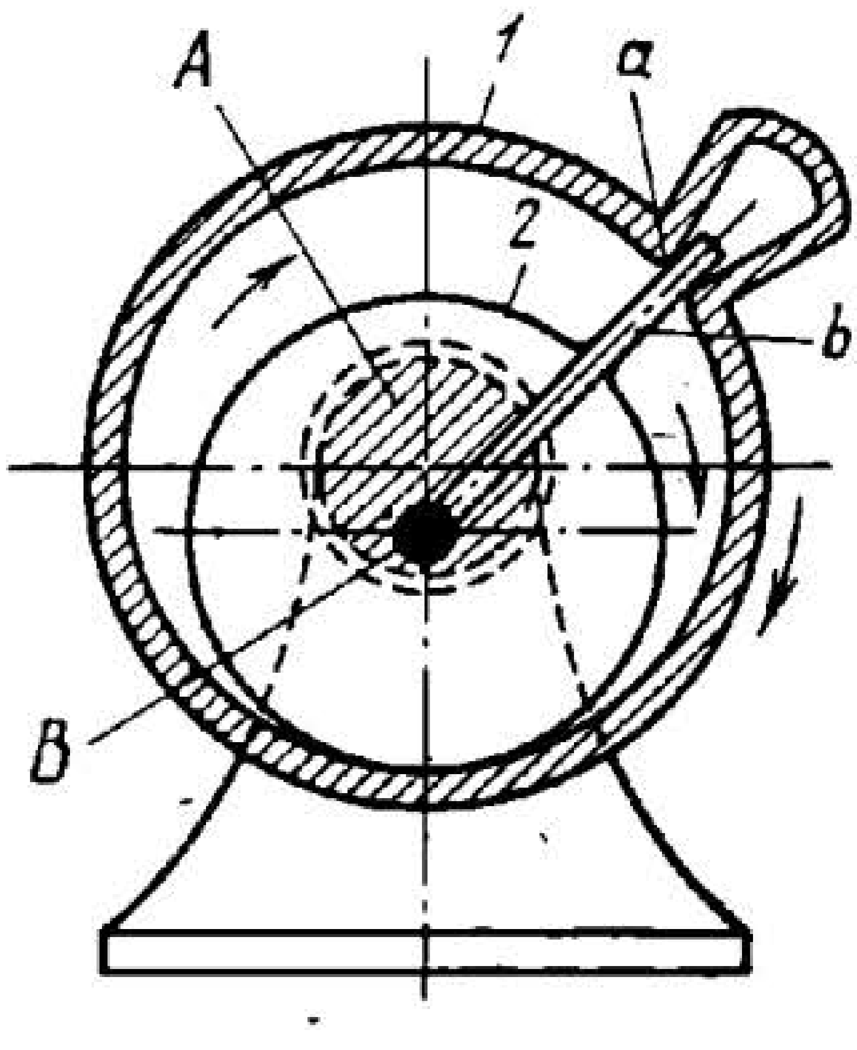
3844	SLIDER-CRANK MECHANISM OF A ROTARY PUMP	LHP RP

Crank *1* rotates about fixed axis *A* and is connected by turning pair *B* to connecting rod *2* which is rigidly attached to circular housing member *a*. Connecting rod *2* is connected by turning pair *C* to slider *6* which reciprocates along fixed guide slot *b*. When crank *1* rotates, housing member *a* rolls and slides with its internal surface around the external surface of fixed sleeve *4*. Link *3*, turning about fixed axis *D*, is connected by a sliding pair to bearing member *5* which, in turn, is connected by turning pair *E* to connecting rod *2*. Link *3* separates the suction and discharge chambers formed by member *a* and sleeve *4*. Liquid is delivered in the direction of the arrows.

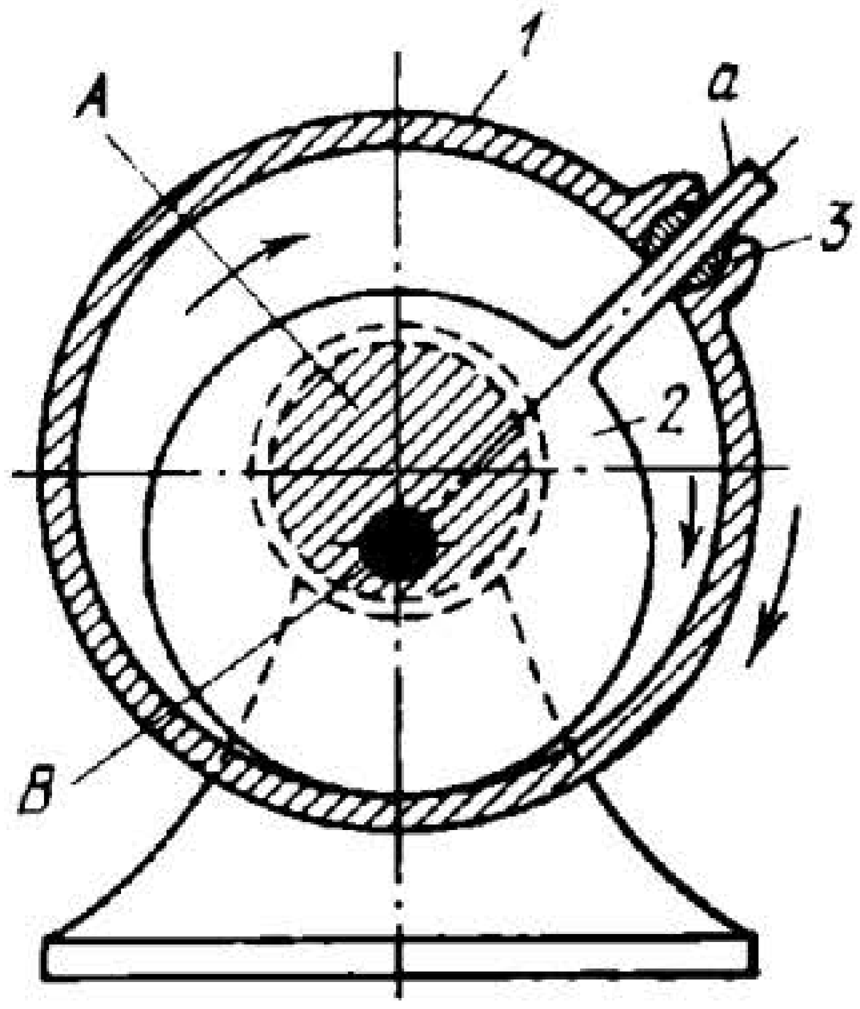


3845	LINK-GEAR MECHANISM OF A ROTARY-HOUSING PUMP	LHP RP

Housing *1* rotates about fixed axis *A* and rolls and slides around member *2* which rotates about fixed axis *B*. Vane *b* of member *2* slides in angular guides *a* of housing *1*. When housing *1* rotates, liquid is delivered in the direction of the arrows. The input and discharge channels are not shown.

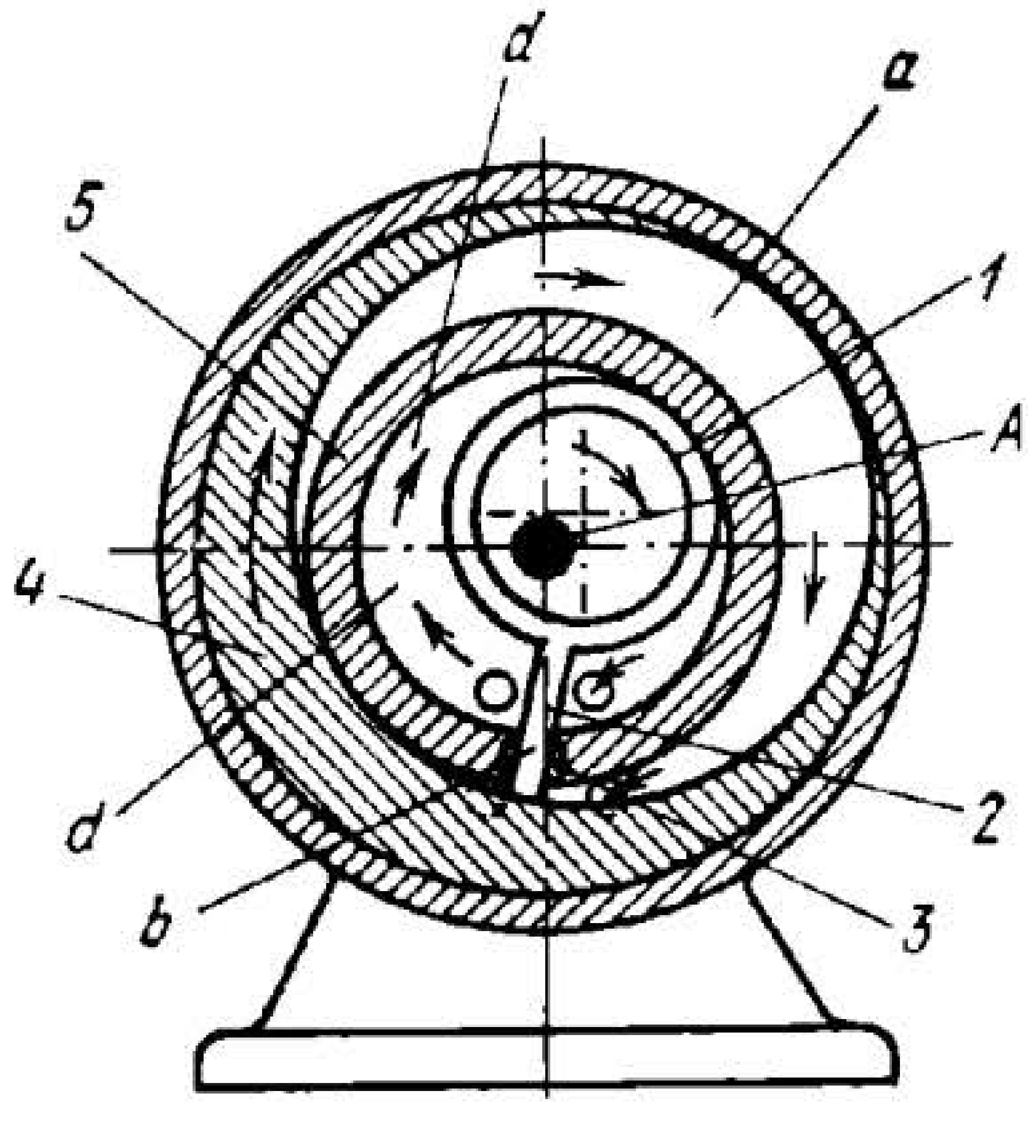


3846	LINK-GEAR MECHANISM OF A ROTARY HOUSING PUMP	LHP RP



Housing *1* rotates about fixed axis *A* and rolls and slides around member *2* which rotates about fixed axis *B*. Vane *a* of member *2* slides in bearing member *3* which is connected by a turning pair to housing *1*. When housing *1* rotates, liquid is delivered in the direction of the arrows. The input and discharge channels are not shown.

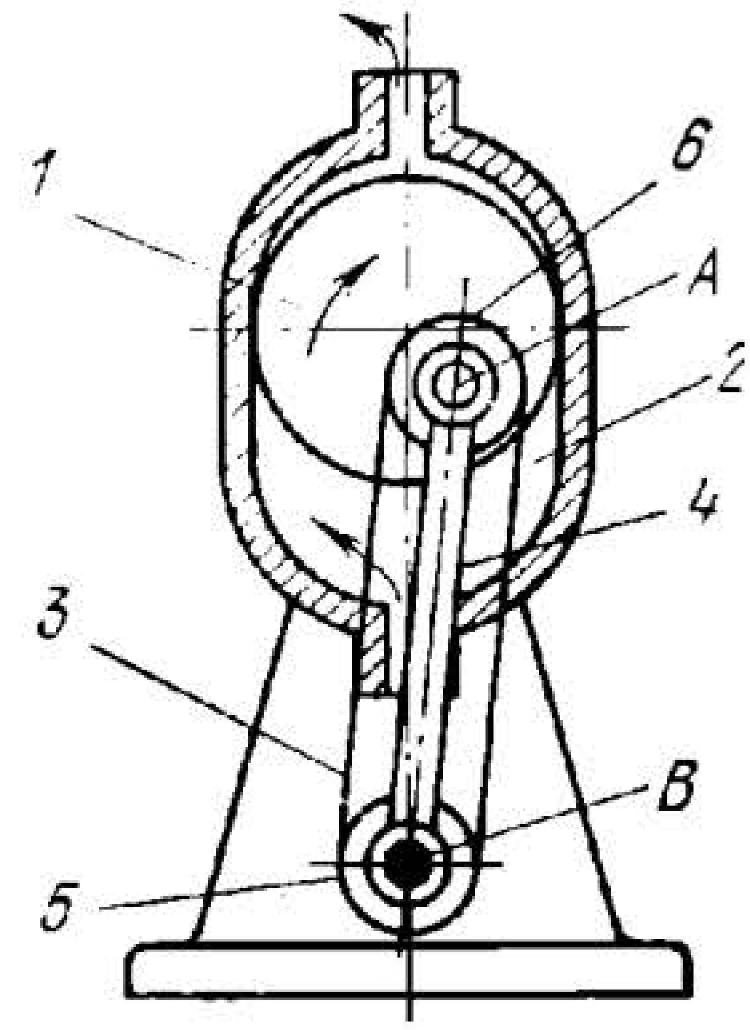
3847	LINK-GEAR ECCENTRIC MECHANISM OF A ROTARY PUMP	LHP RP



Circular eccentric *1* and link *4*, having an eccentrically located cylindrical chamber *a*, rotate about fixed axis *A*. Eccentric *1* is connected by a turning pair to collar *2* whose shank *b* slides in bearing member *3*. Member *3* is connected by a turning pair to fixed sleeve *5*. When eccentric *1* rotates, liquid in chambers *a* and *d* is delivered in the direction of the arrows.

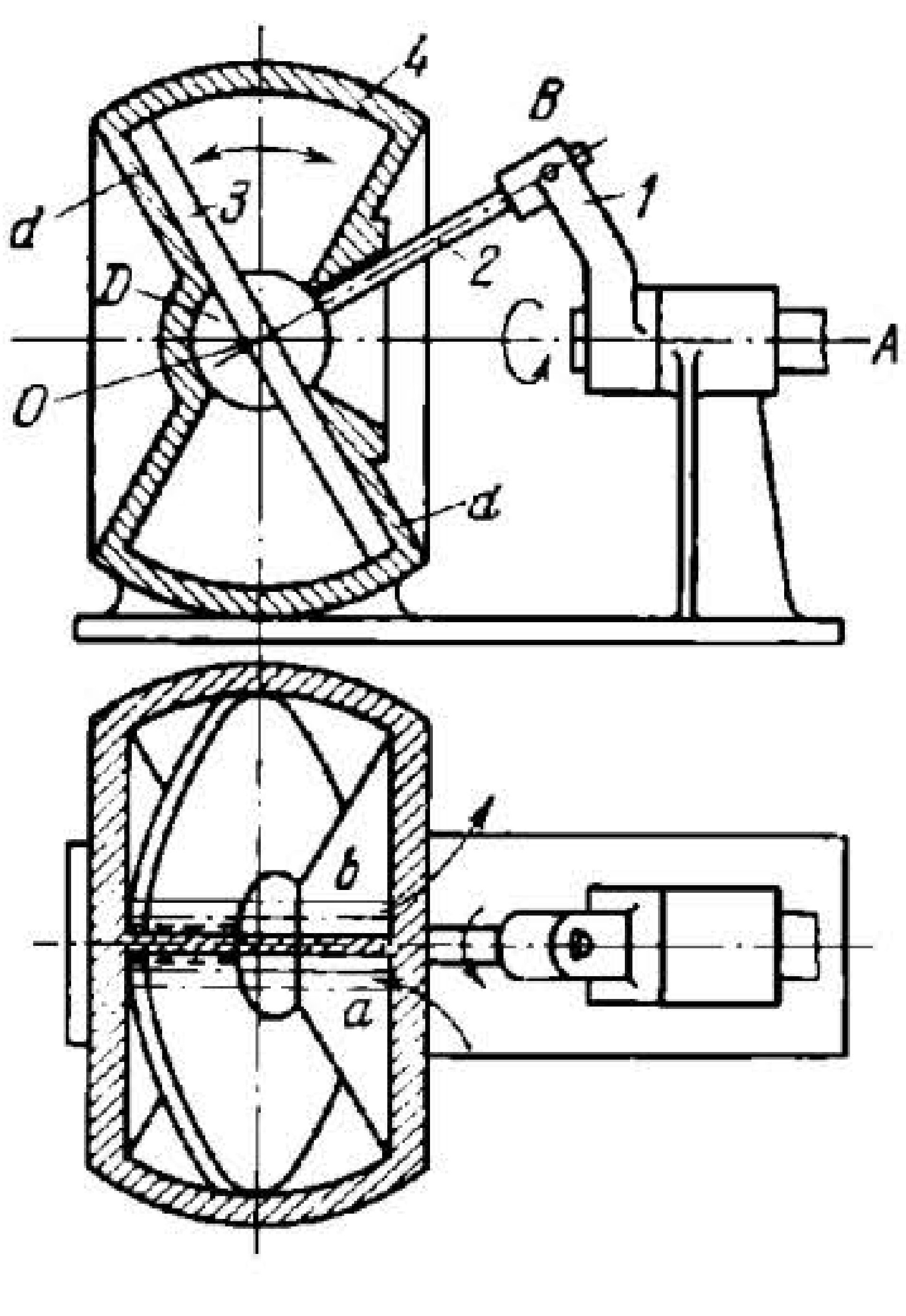
3848	LEVER MECHANISM OF A PUMP WITH AN ECCENTRIC IN A HOUSING	LHP RP

Circular eccentric *1* is connected by turning pair *A* to rocker arm *4* which oscillates about fixed axis *B*. Pulley *5* rotates about axis *B* and transmits rotation through flexible link *3* to pulley *6* of equal diameter which is rigidly attached to eccentric *1*. When eccentric *1* rotates, it moves up and down in chamber *2*, serving as a piston in a cylinder.

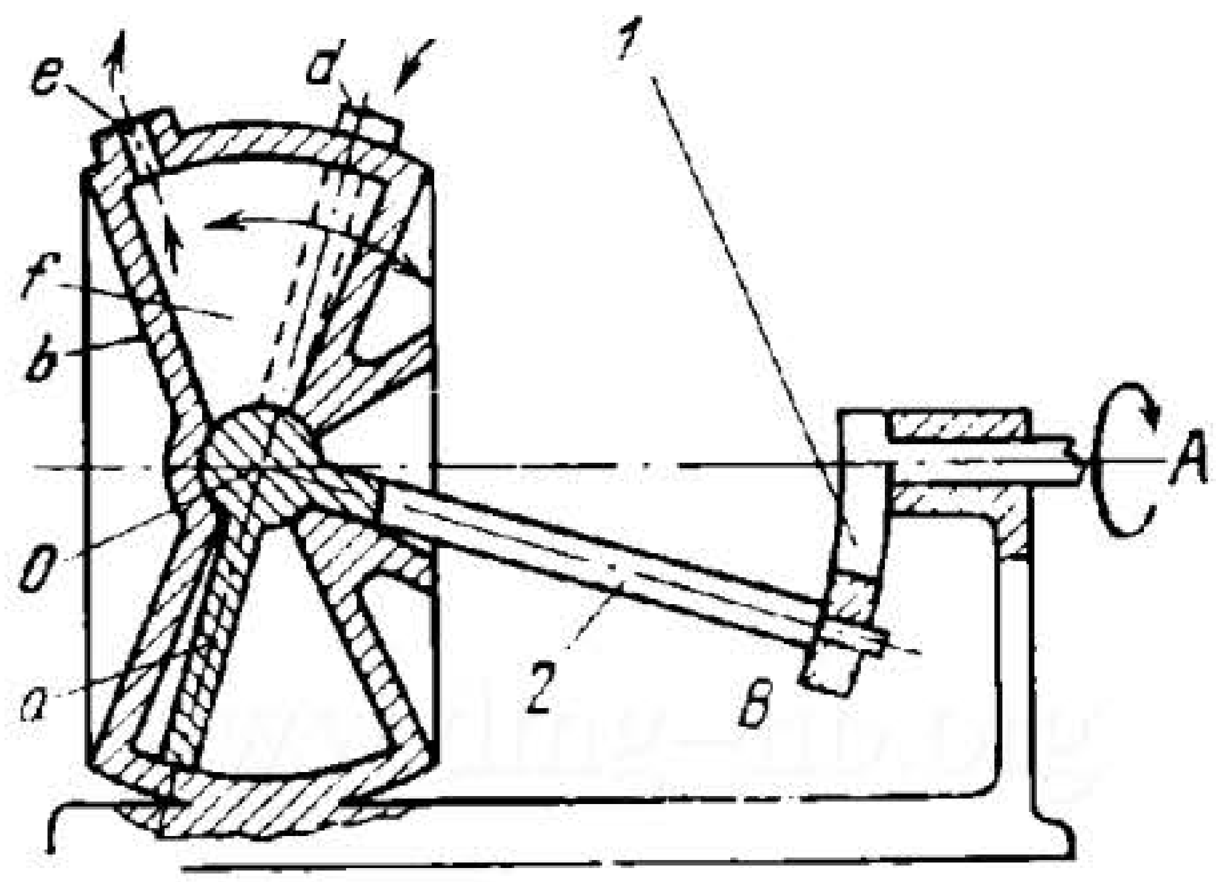


3849	SPHERICAL MECHANISM OF A WOBBLE-PLATE PUMP	LHP RP

Crank *1* rotates about fixed axis *A* and is connected by turning pair *B* to link *2* which has spherical bearing *D*. Axes *A* and *B* intersect at point *O*, the centre of spherical bearing *D*. Wobble plate *3*, mounted perpendicular to the axis of link *2*, rolls over two fixed cones *d* of housing *4*. When crank *1* rotates, two chambers: suction and discharge, are formed between plate *3* and housing *4*. Liquid is drawn in and delivered through channels *a* and *b*.



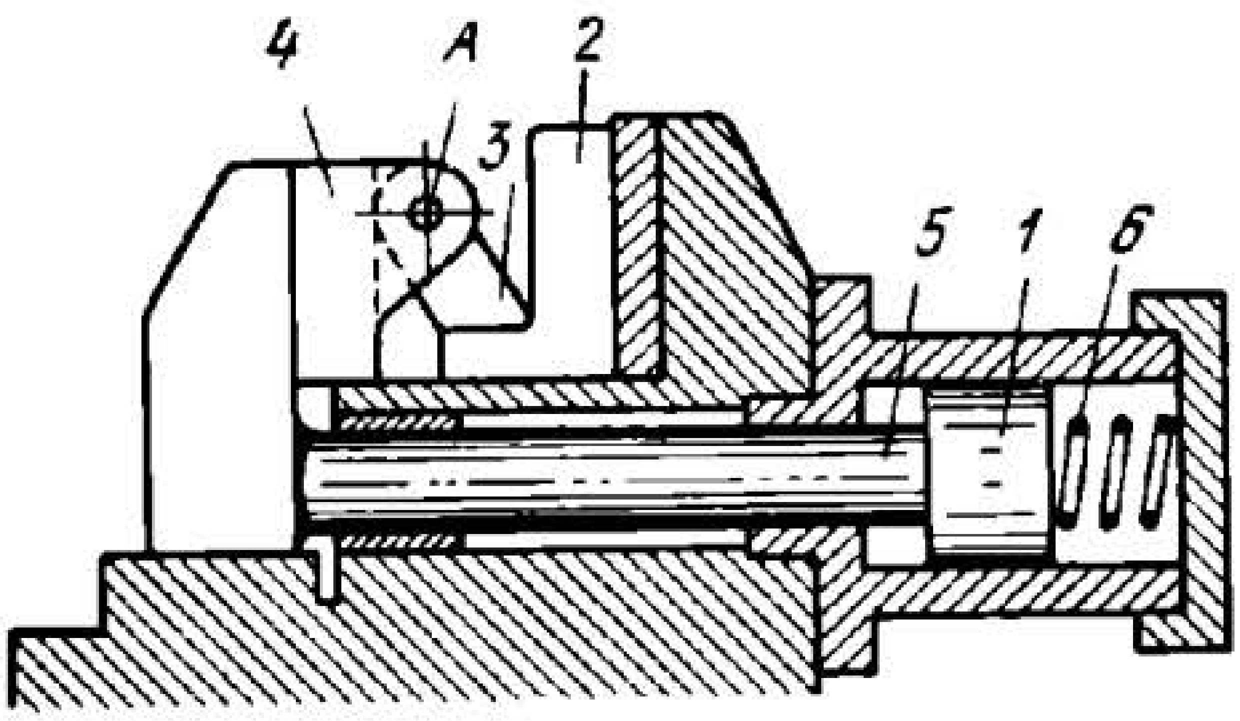
3850	SPHERICAL MECHANISM OF A WOBBLE-PLATE PUMP WITH A PARTITION	LHP RP



Crank *1* rotates about fixed axis *A* and is connected by turning pair *B* to link *2* which has a spherical bearing. Axes *A* and *B* intersect at point *O*, the centre of the spherical bearing. Wobble plate *a*, mounted perpendicular to the axis of link *2*, rolls over two fixed cones *b* of the housing. When crank *1* rotates, plate *a* delivers liquid in the chambers of the pump from suction input *d* to discharge output *e*. The suction and discharge chambers are separated by partition *f* in the plane of the drawing.

2. GRIPPING, CLAMPING AND EXPANDING MECHANISMS (3851 through 3892)

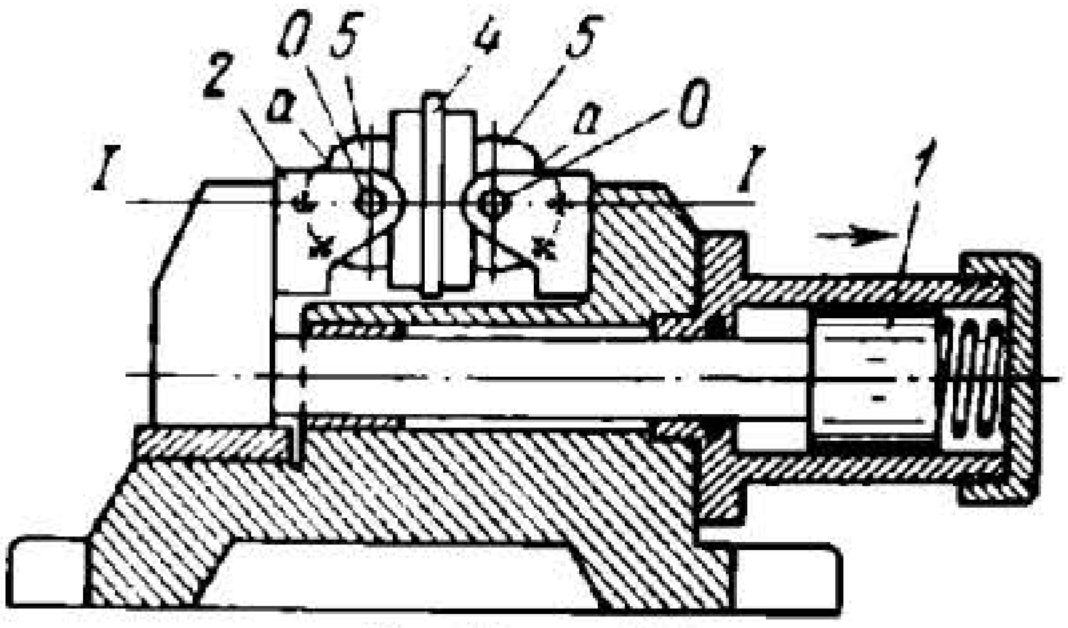
3851	LEVER MECHANISM OF A HYDRAULIC VISE WITH A HINGED CLAMP	LHP GC



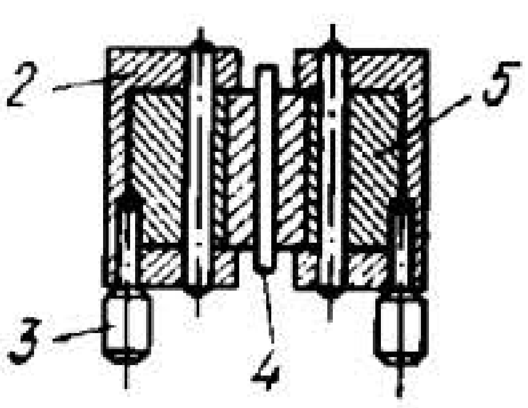
When piston *1* moves to the right by the action of fluid delivered to the left end of the cylinder, hinged clamp *3* clamps workpiece *2*. Clamp *3* is connected by turning pair *A* to movable jaw *4* which is rigidly attached to rod *5* of piston *1*. As piston *1* is moved to the left by spring *6*, workpiece *2* is released.

3852	LEVER MECHANISM OF A HYDRAULIC UNIVERSAL-JAW VISE	LHP GC

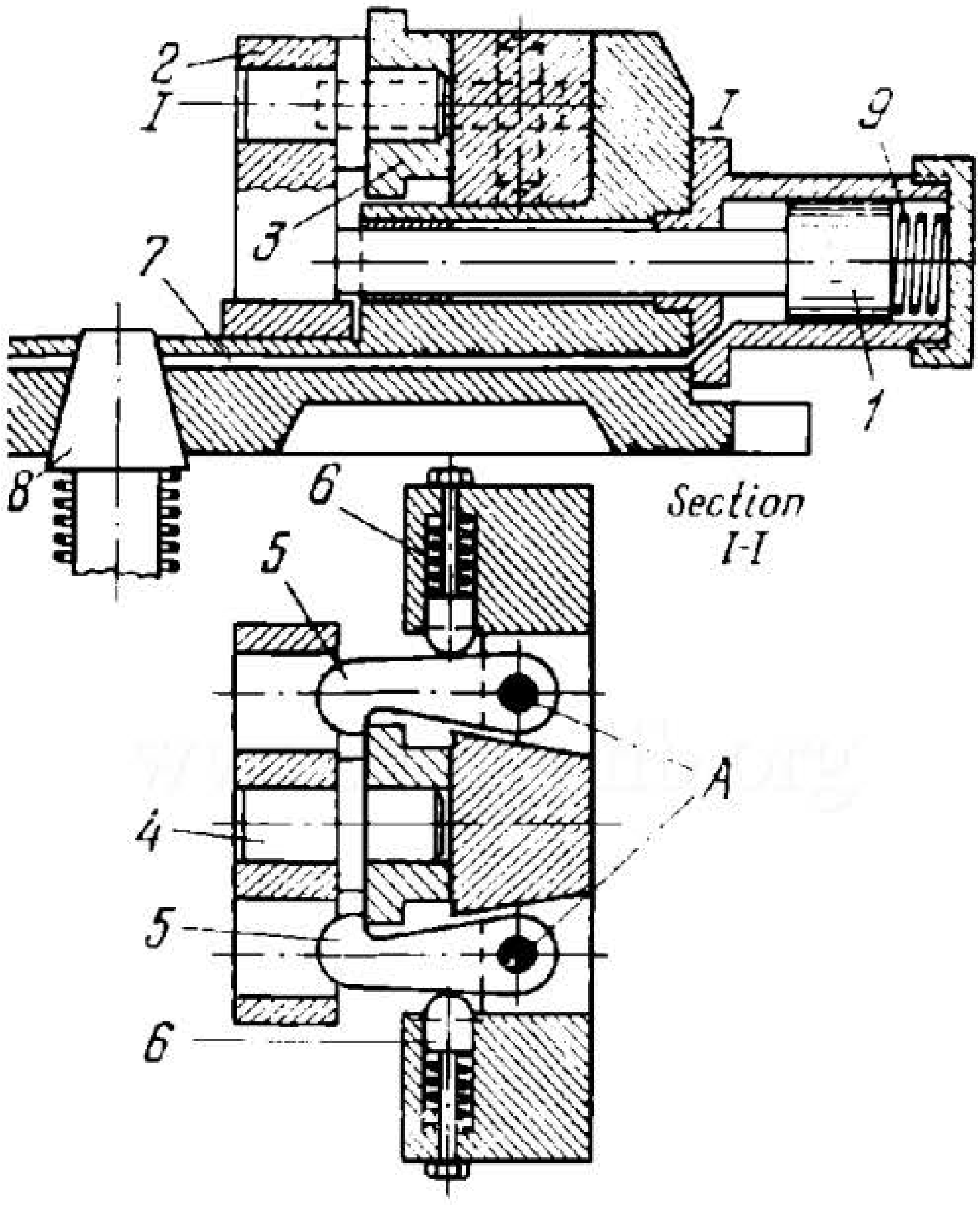
When piston *1* moves to the right by the action of fluid delivered to the left end of the cylinder, workpiece *4* is clamped by universal swivelling jaws *5*. Each swivelling jaw is a semicylinder rocking about axis *O* and bearing against the cylindrical recess in jaw holders *2*. Jaws *5* are set to the required angle by means of two pins *3* which are inserted through holes in the jaw holders into recesses *a* of jaws *5*. The vise can clamp work with either parallel or inclined side surfaces and the work can be set and clamped at the required angle.



Section I-I

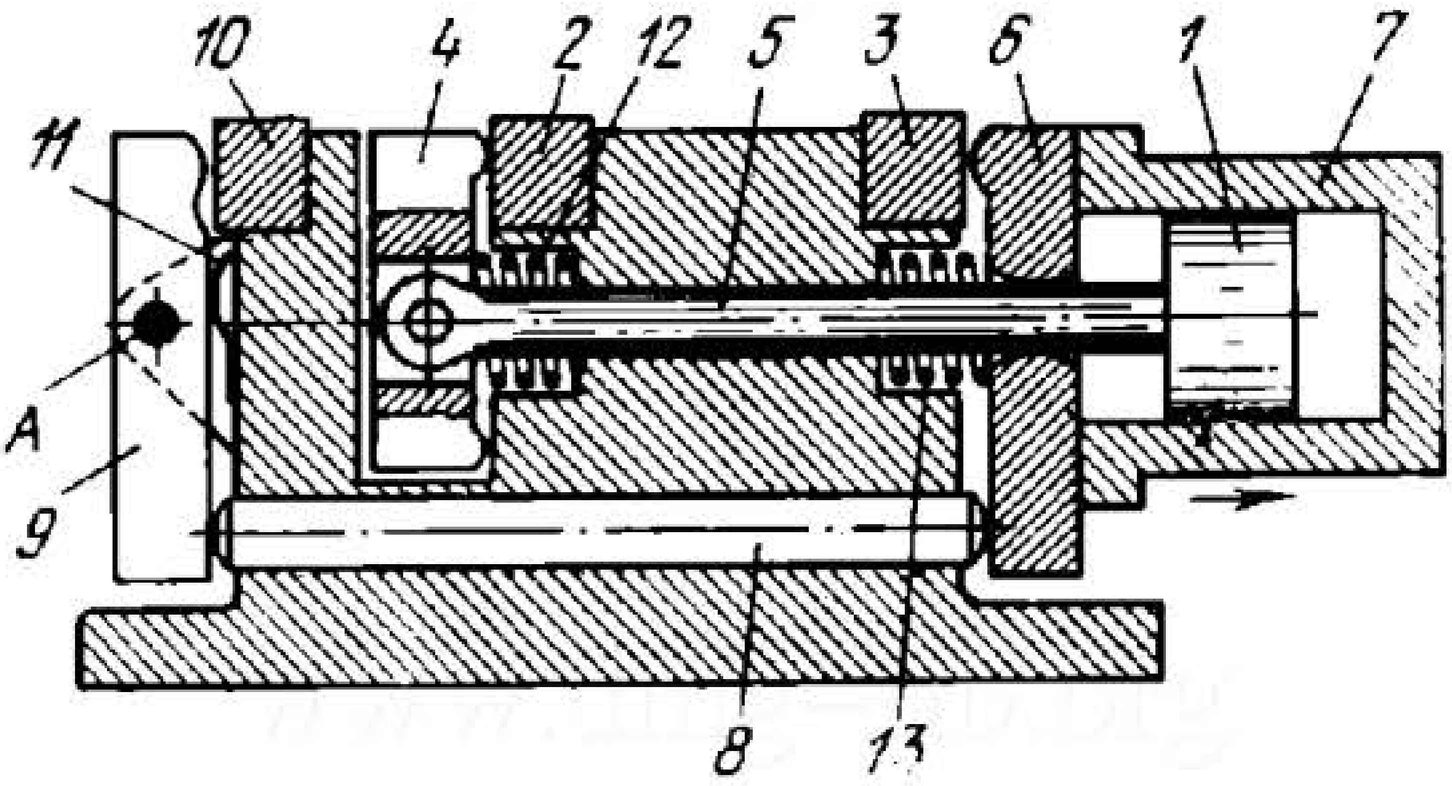


3853	LEVER MECHANISM OF A HYDRAULIC VISE WITH LATCH LEVERS	LHP GC



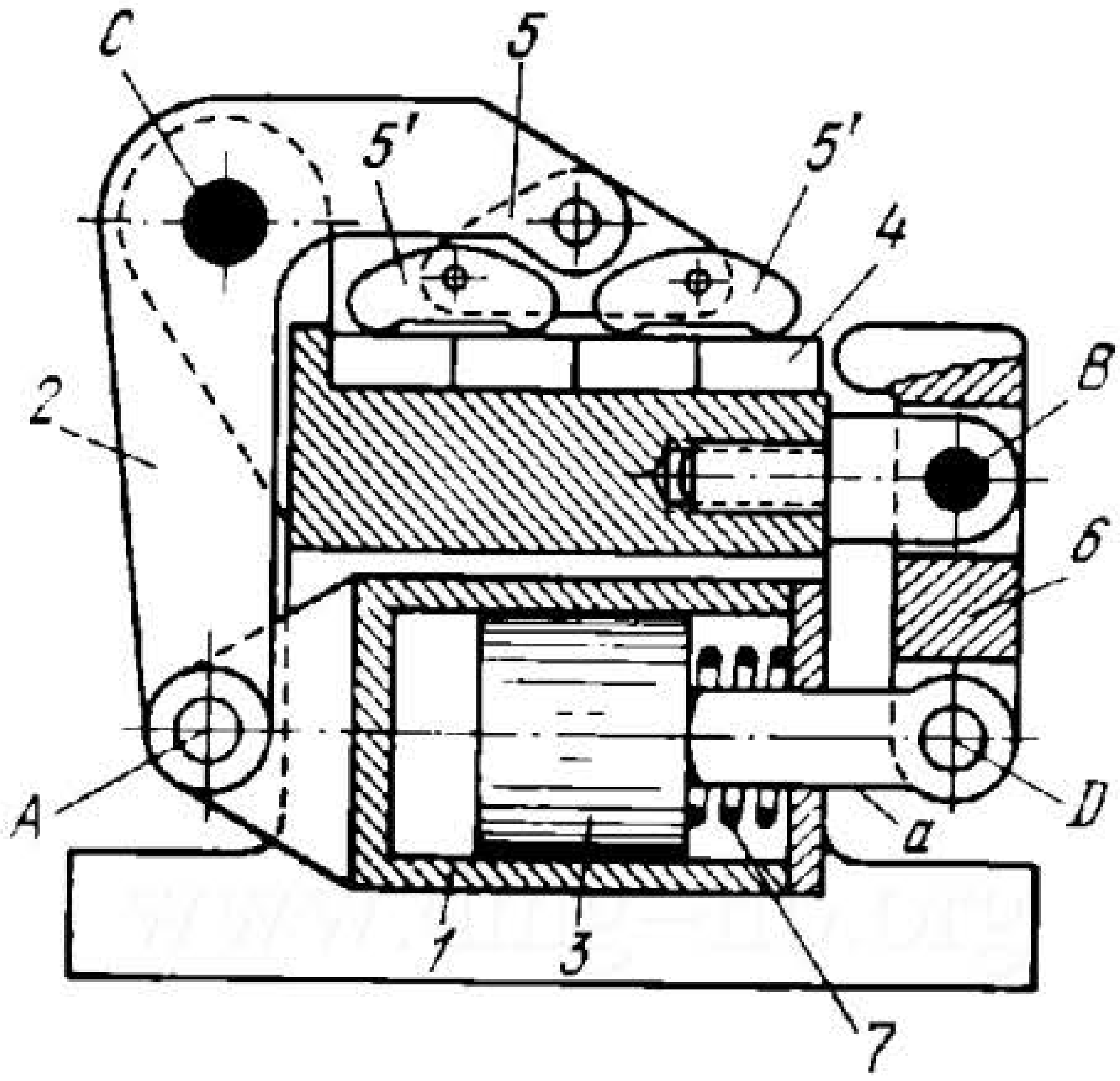
When piston *1* moves to the right by the action of fluid delivered to the left end of the cylinder, movable jaw *2* clamps workpiece *3* located on pin *4*. At this, latch levers *5*, turning about fixed axes *A* and actuated by spring-loaded plungers *6*, snap over the workpiece. Fluid is delivered to the cylinder through channel *7* and is controlled by directional valve *8*. As piston *1* is moved to the left by spring *9*, workpiece *3* is released and latch levers *5* pull it off pin *4*.

3854	LEVER MECHANISM OF A MULTIPLE-ACTION HYDRAULIC VISE	LHP GC



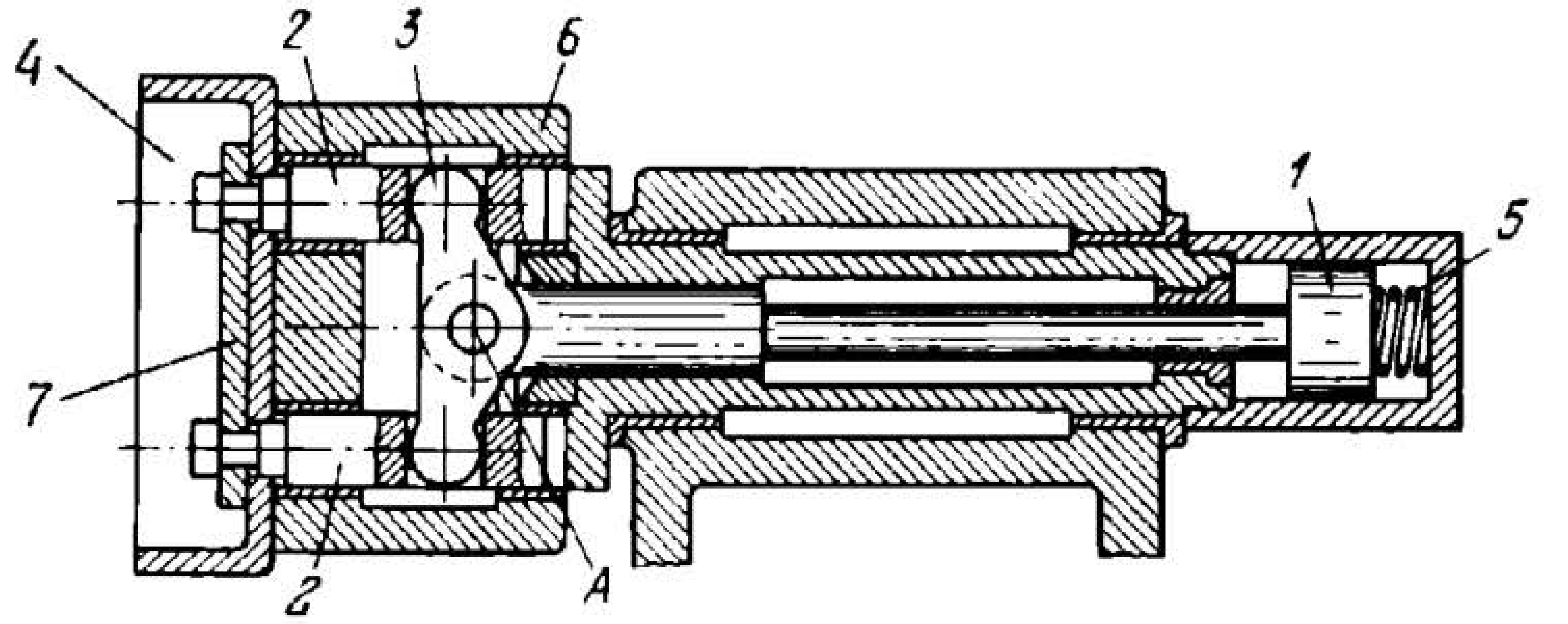
When piston *1* moves to the right by the action of fluid delivered to the left end of cylinder 7, workpieces *2* and *3* are clamped by clamp *4*, hinged to rod *5*, and clamp *6*, rigidly attached to cylinder 7. At the same time, clamp *6*, moving to the left with cylinder 7, pushes pin *8* which turns clamp *9* about fixed axis *A*, clamping third workpiece *10*. The workpieces are released and the cylinder, piston and clamps are returned to their initial positions by springs *11*, *12* and *13*.

3855	LEVER MECHANISM OF A HYDRAULIC MULTIPLE CLAMPING DEVICE	LHP GC



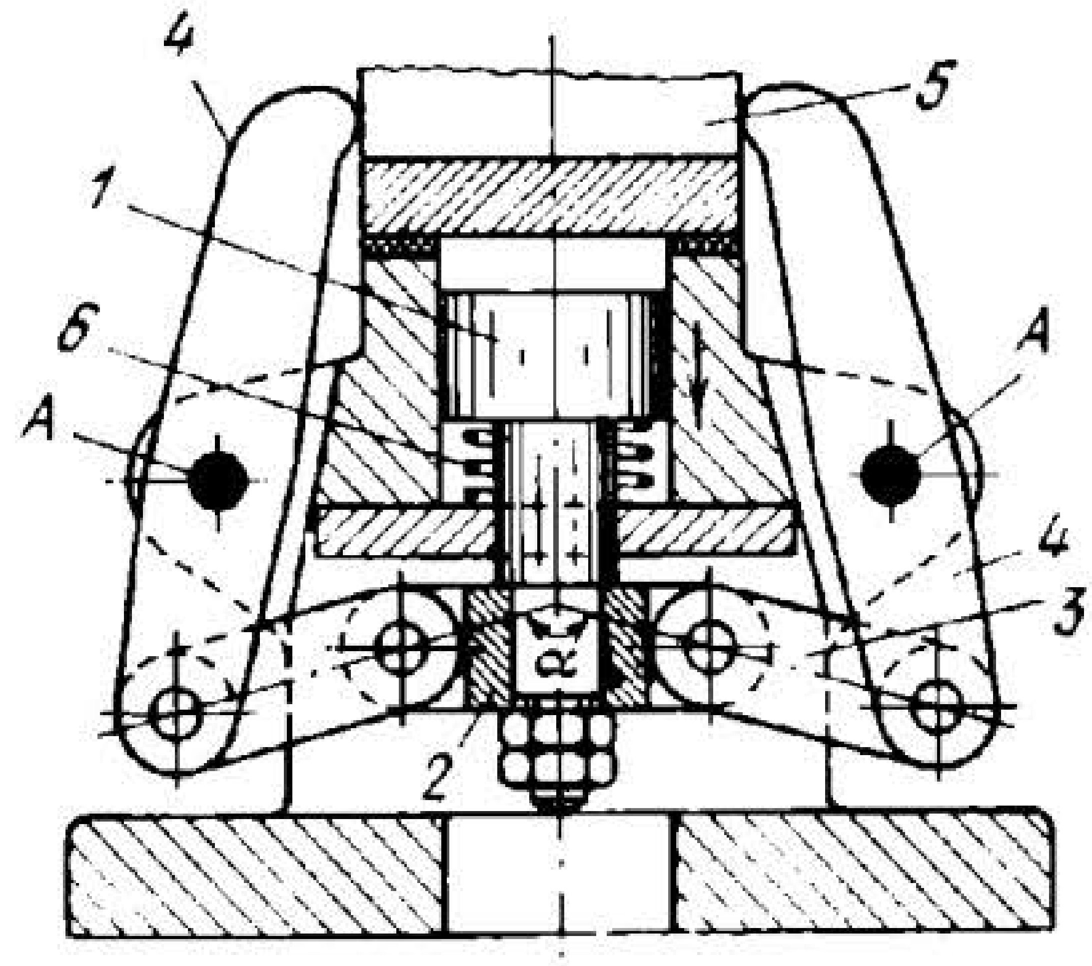
When fluid is delivered into the left end of cylinder *1*, it moves to the left and piston *3* moves to the right. Cylinder *1* is connected by turning pair *A* to rocker arm *2* which turns about fixed axis *C* and, by means of crosspiece *5* and swivelling clamps *5'*, clamps four workpieces *4* in the vertical direction. At the same time, piston *3*, whose rod *a* is connected by turning pair *D* to pivoted clamp *6*, turns the clamp about fixed axis *B*, clamping workpieces *4* in the horizontal direction. The cylinder, piston, rocker arm and clamps are returned by spring *7* to their initial positions, releasing workpieces *4*.

3856	LEVER MECHANISM OF A CLAMPING DEVICE WITH LOCATING PINS	LHP GC



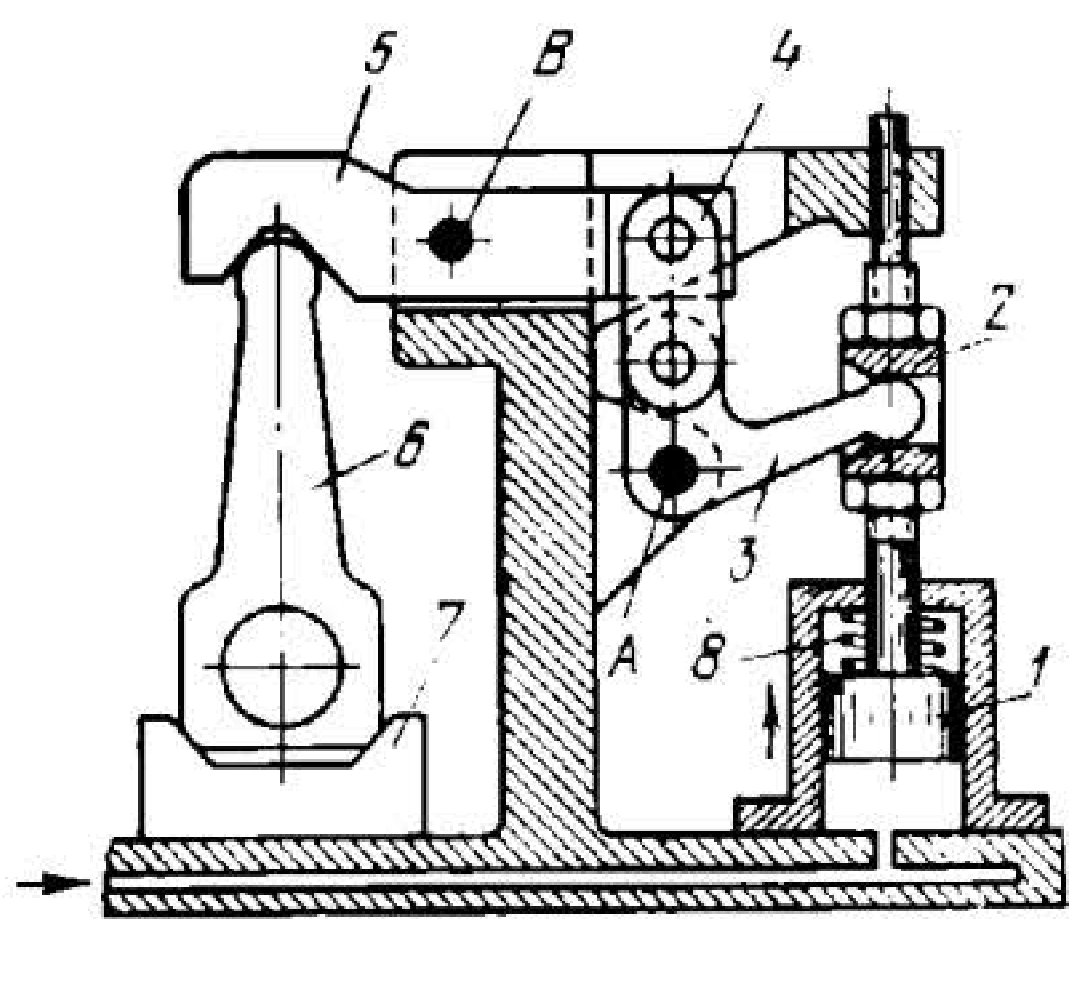
Workpiece *4* is mounted on two locating pins *2*. One pin has a cylindrical locating surface and the other a diamond-shaped surface with the larger axis of the diamond pin perpendicular to the line of centres through the pins. A diamond locating pin is required so that the workpiece can be readily mounted on the pins even with deviations in the centre-to-centre distance between its holes. Rocker arm *3*, connected by turning pair *A* to the rod of piston *1*, has rounded ends fitting into slots in pins *2*. When piston *1* moves to the right by the action of fluid delivered to the left end of its cylinder, workpiece *4* is clamped against the end face of housing *6* by slotted strap *7* that engages the heads of locating pins *2*. As piston *1* is moved to the left by spring *5*, workpiece *4* is released and, after removing strap *7*, can be taken off pins *2*.

3857	LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



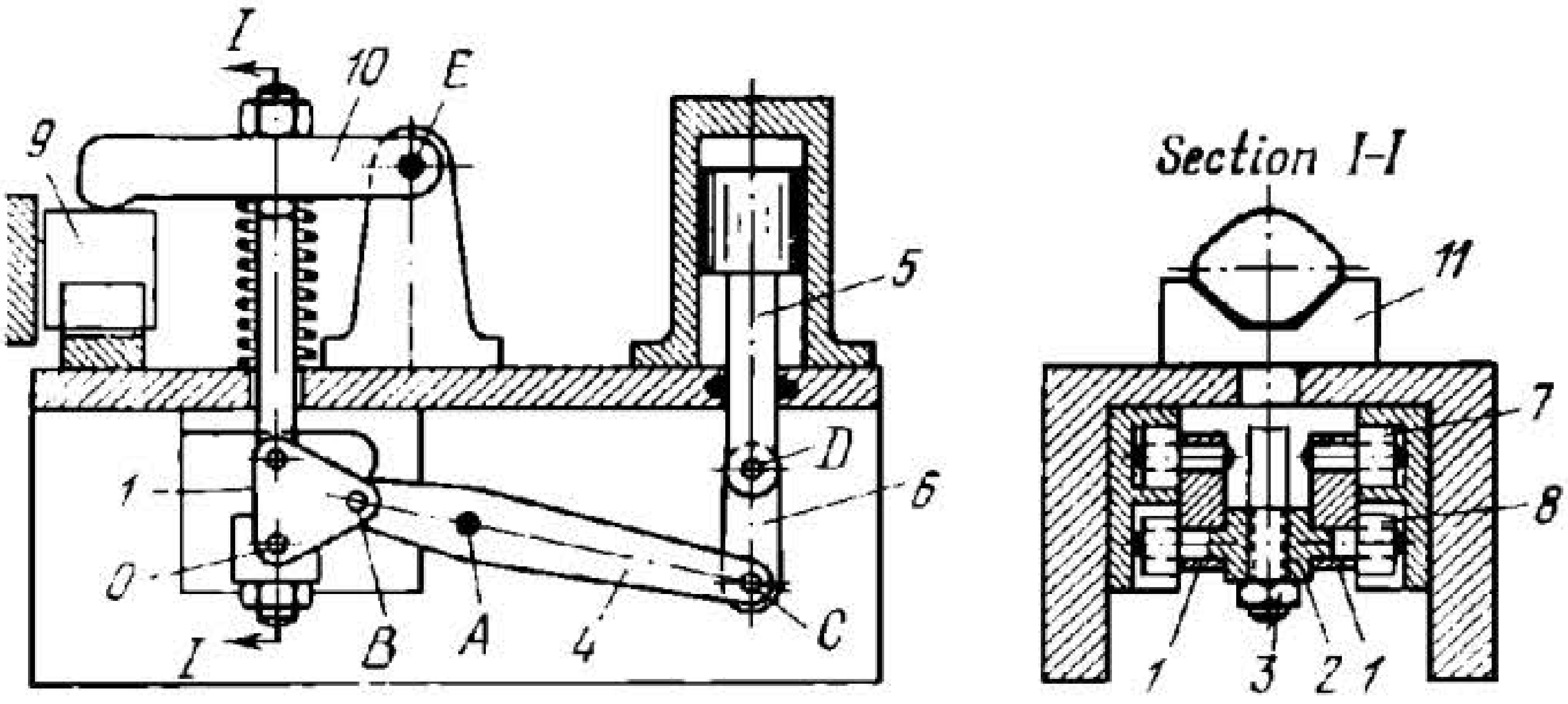
When piston 1 moves downward by the action of fluid delivered to the top end of the cylinder, motion is transmitted through yoke 2 and links 3 to levers 4 which turn about fixed axes A and clamp workpiece 5. The maximum clamping force is exerted at an angle α approaching 180°. Workpiece 5 is released when piston 1 is moved upward by spring 6.

3858	LEVER MECHANISM OF A HYDRAULIC CLAMPING MECHANISM	LHP GC



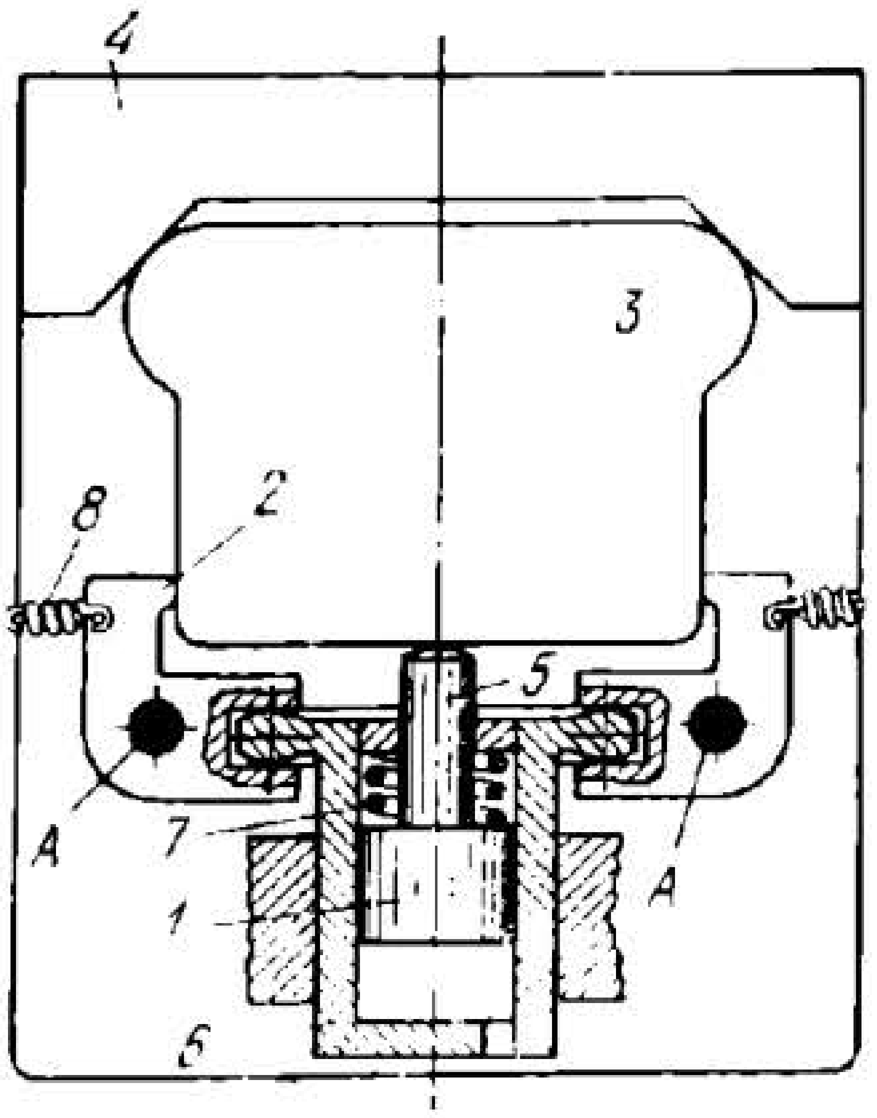
When piston 1 moves upward by the action of fluid delivered to the bottom end of the cylinder, yoke 2, secured on the piston rod, turns bell-crank lever 3 about fixed axis A. The rounded end of one arm of lever 3 fits into the slot of yoke 2. Lever 3 transmits motion through link 4 to lever 5 which turns about fixed axis B and clamps workpiece 6 located in V-block 7. Workpiece 6 is released and all the links are returned to their initial positions when piston 1 is moved downward by spring 8.

3859	LEVER MECHANISM OF A HYDRAULIC ROLLER-TYPE CLAMPING DEVICE	LHP GC



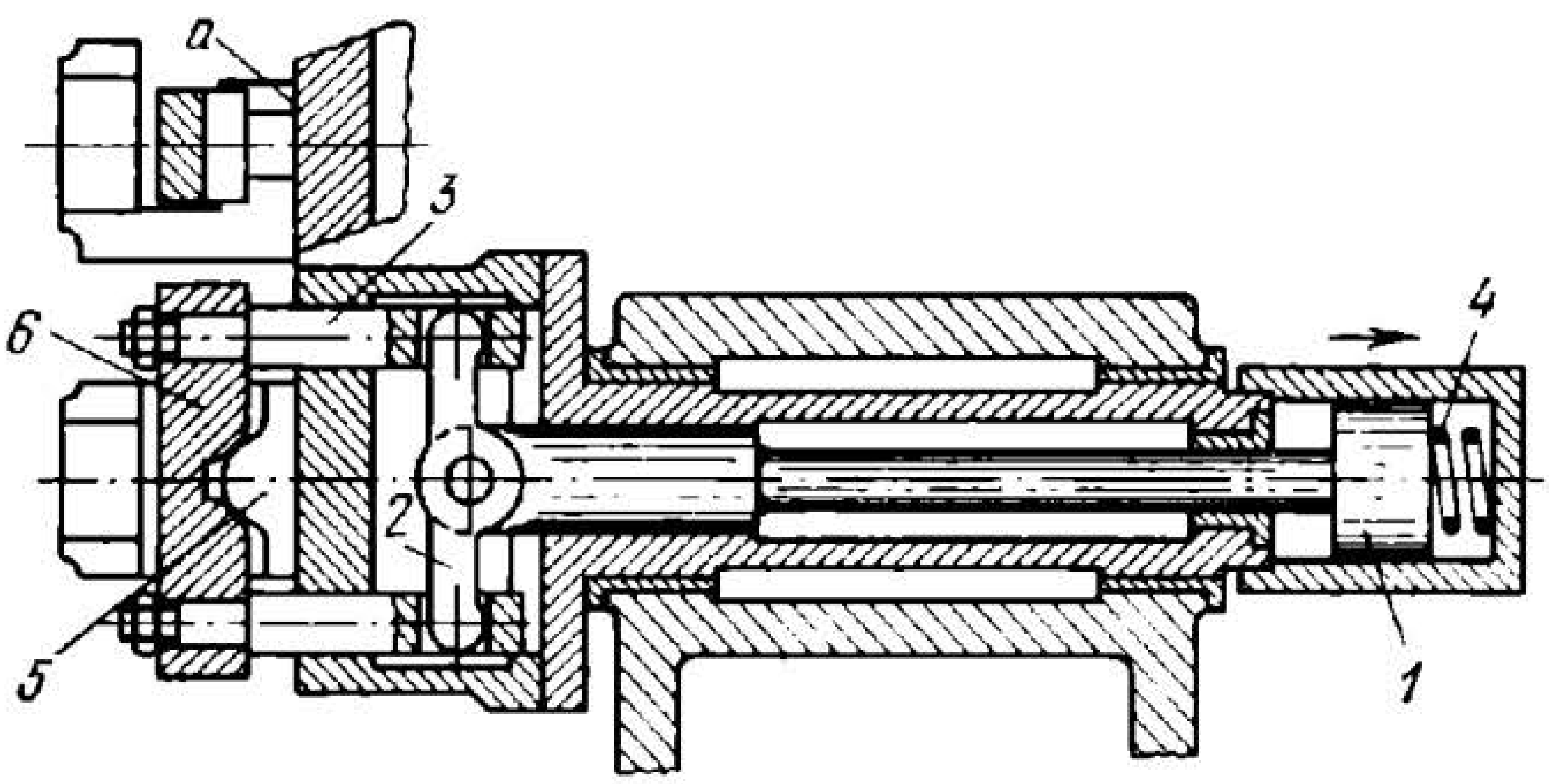
Two triangular plates *1* are linked together with turning pairs by crosspiece *2* and rocker arm *4*. Rocker arm *4* turns about fixed axis *A* and is connected by turning pairs *B* and *C* to plates *1* and to link *6*, which, in turn, is connected by turning pair *D* to the rod of piston *5*. Pressfitted into the triangular plates are four axles on which four rollers are mounted and rotate. Two rollers *7* roll and slide along horizontal slots in the body of the device, and two rollers *8* along vertical slots. When piston *5* moves downward by the action of fluid delivered to the upper end of the cylinder, plates *1* turn about point *O*, tending to position all the axes of the rollers in a single vertical plane. At this, crosspiece *2*, together with inserted clamping bolt *3*, moves downward, turning clamp *10* about fixed axis *E* to clamp workpiece *9* which is located by V-block *11*. To release the workpiece, liquid is delivered to the bottom end of the cylinder, moving piston *5* upward. This turns triangular plates *1* in the reverse direction, rollers *7* slide along the horizontal slots to the right; rollers *8* slide along the vertical slots upward, raising crosspiece *2* and bolt *3*.

3860	LEVER MECHANISM OF A FLOATING-CYLINDER HYDRAULIC CLAMPING DEVICE	LHP GC



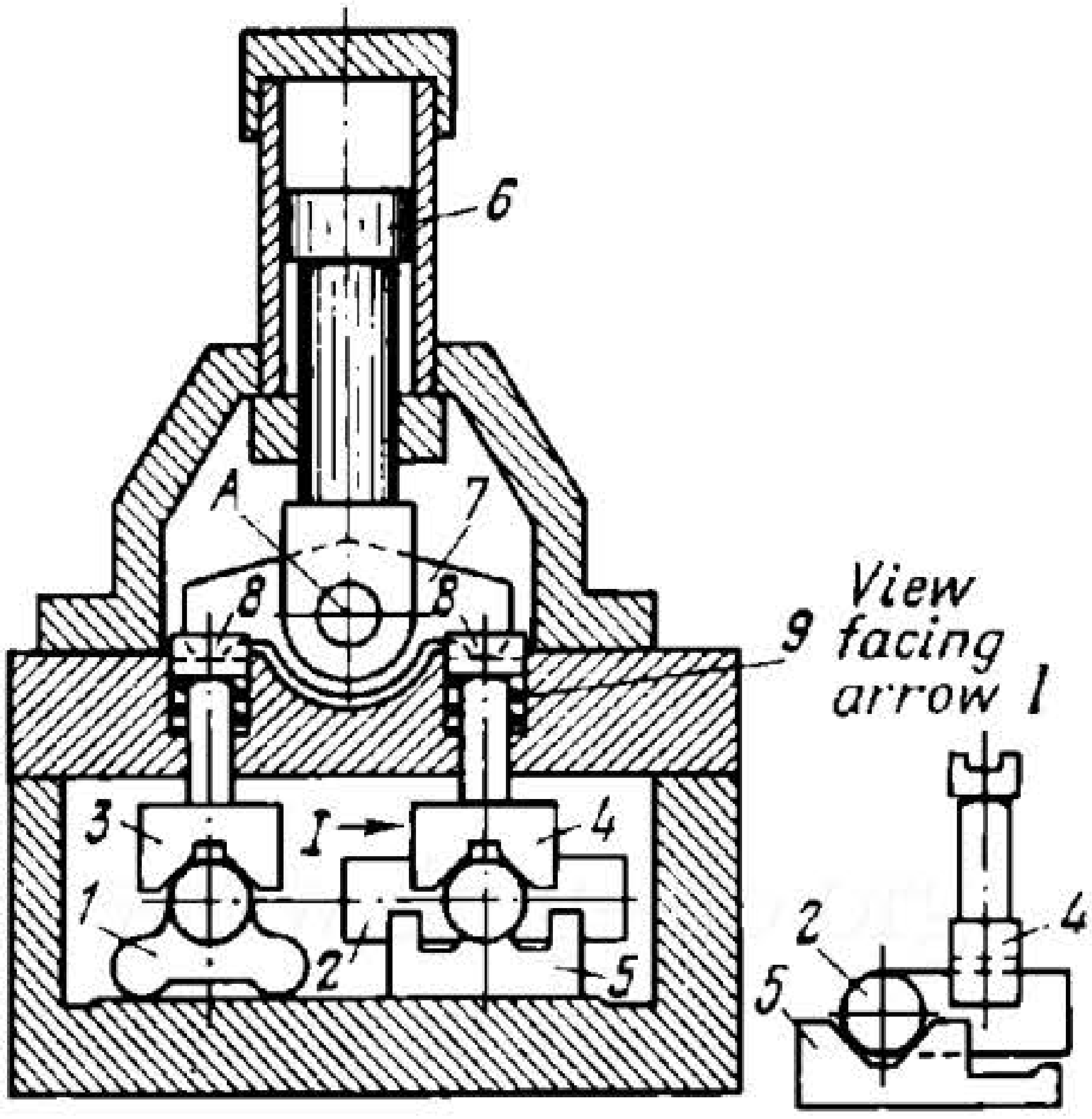
Workpiece *3* is located by V-block *4* and levers *2* which turn about fixed axes *A*. When piston *1* moves upward by the action of fluid delivered to the bottom end of cylinder *6*, piston rod *5* clamps workpiece *3* in V-block *4*. Cylinder *6*, floating in the body of the device, moves downward and locates and clamps workpiece *3* by means of levers *2*. The workpiece is released, and the piston, cylinder and levers are returned to their initial position by springs *7* and *8*.

3861	LEVER MECHANISM OF A HYDRAULIC LOCATING AND CLAMPING DEVICE	LHP GC



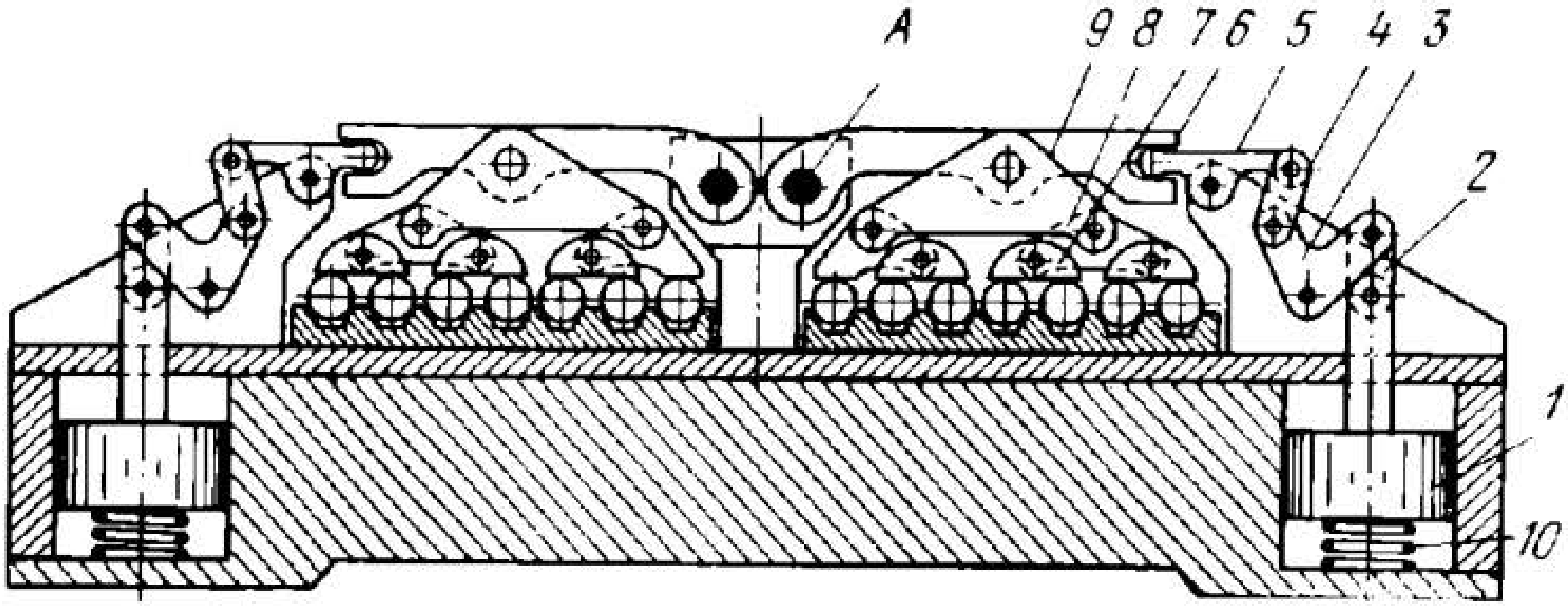
When piston *1* moves to the right by the action of liquid delivered to the left end of the cylinder, rocker arm *2*, whose rounded ends enter slots in clamping bolts *3*, moves the bolts and V-block *6*, clamping workpiece *5* against locating surface *a*. Workpiece *5* is released when piston *1* is moved to the left by spring *4*.

3862	LEVER MECHANISM OF A HYDRAULIC MULTIPLE-ACTION CLAMPING DEVICE	LHP GC



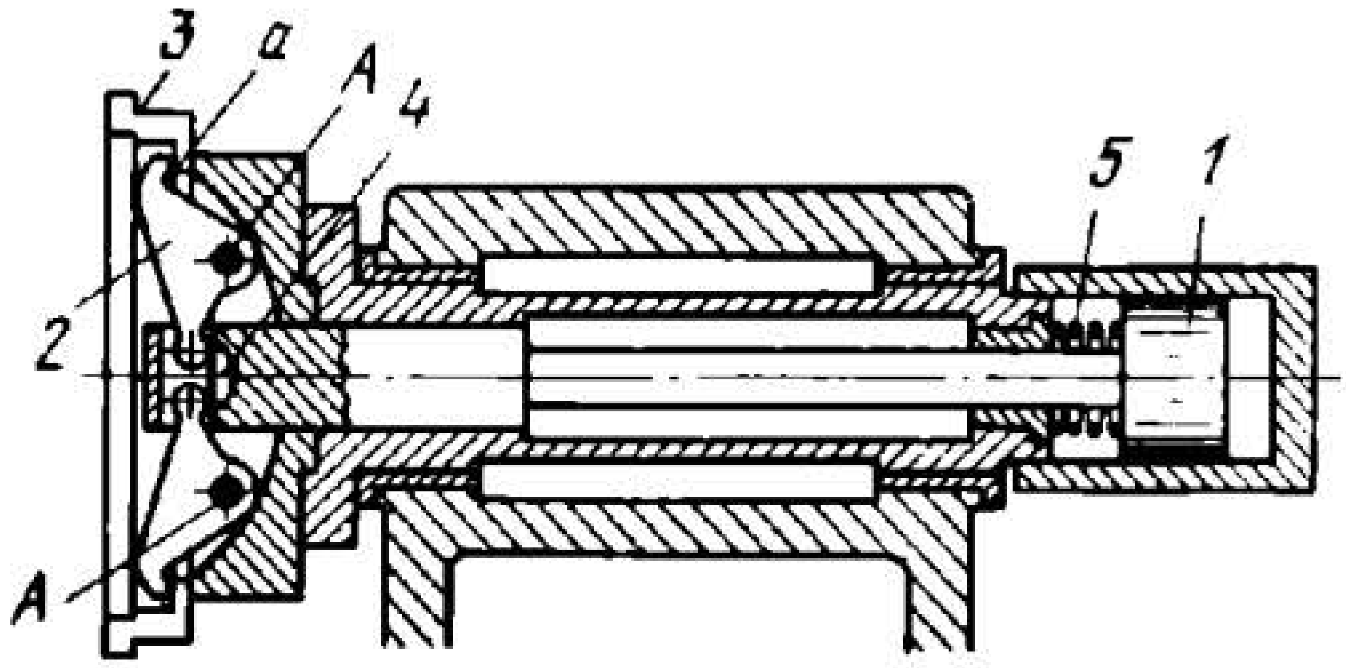
Workpiece *1* is located by its three parallel cylindrical surfaces of which two bear against a flat surface of the body and the third is located by V-block *3*. Workpiece *2* is located by two perpendicular V-blocks *4* and *5*. When piston *6* moves downward by the action of fluid delivered to the top end of the cylinder, rocker arm 7, connected by turning pair *A* to the piston rod, actuates plungers *8* so that the workpieces are clamped and located by V-blocks *3* and *4*. Plungers *8* are retracted with the V-blocks by springs *9* to release the workpieces.

3863	LEVER MECHANISM OF A DOUBLE HYDRAULIC CLAMPING DEVICE FOR RECIPROCAL MACHINING	LHP GC



When piston *1* moves downward by the action of liquid delivered to the top end of the cylinder, motion is transmitted through levers *2*, *3*, *4* and *5* to clamping lever *6* which turns about fixed axis *A*. This clamps the workpieces in V-blocks by a system of rocker clamps *7*, *8* and *9*. The left-hand clamping device is of identical design. The two halves of the device (fixture) operate in a reciprocal machining cycle: while the workpieces in one half are being machined, the finished workpieces are being removed from the other half and new blanks are loaded. The workpieces are released when piston *1* is moved upward by spring *10*.

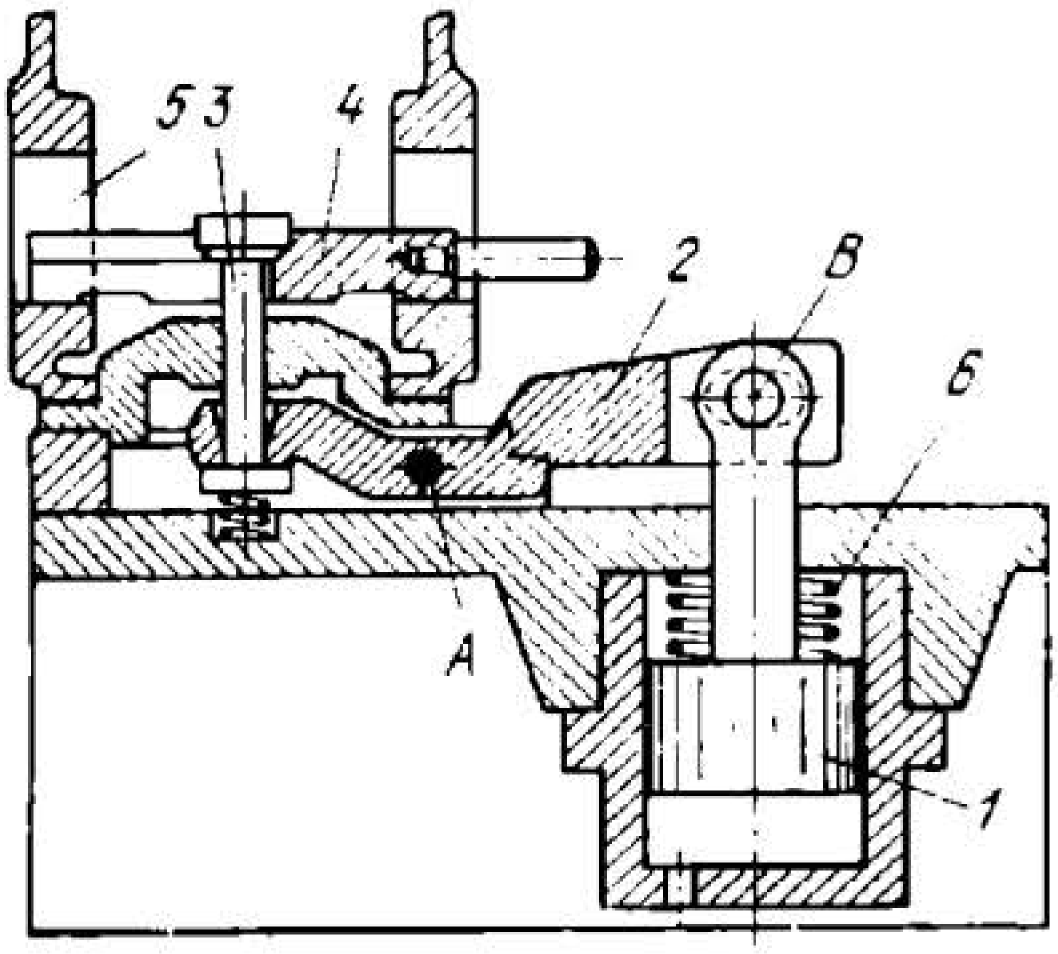
3864	LEVER MECHANISM OF A HYDRAULIC INTERNAL CLAMPING DEVICE	LHP GC



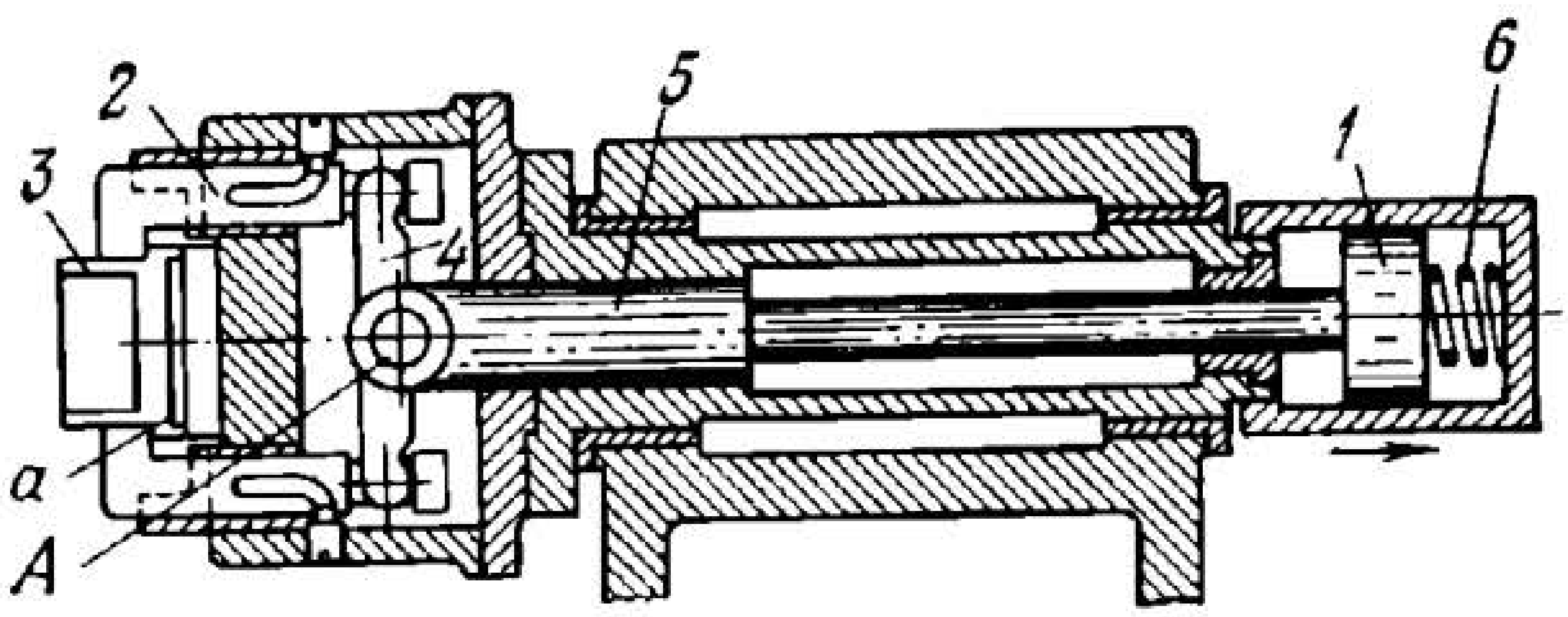
Workpiece *3* is located with its hole on shoulder *a* and is clamped by two levers *2* which turn about fixed axes *A*. When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, motion is transmitted through spherical washer *4* to levers *2*. The workpiece is released and levers *2* are retracted to allow it to be removed when piston *1* is moved to the right by spring *5*.

3865	LEVER MECHANISM OF A HYDRAULIC INTERNAL CLAMPING DEVICE	LHP GC

When piston *1* is moved upward by the action of fluid delivered to the bottom end of the cylinder, motion is transmitted through rocker arm *2*, connected by turning pair *B* to the piston rod and turning about fixed axis *A*, and bolt *3* to removable clamp *4* which clamps workpiece *5*. Clamp *4* is inserted into holes of workpiece *5* and its slot engages the head of bolt *3*. Workpiece *5* is released (after pulling out clamp *4*) and rocker arm *2* and piston *1* are returned to the initial position by spring *6*.

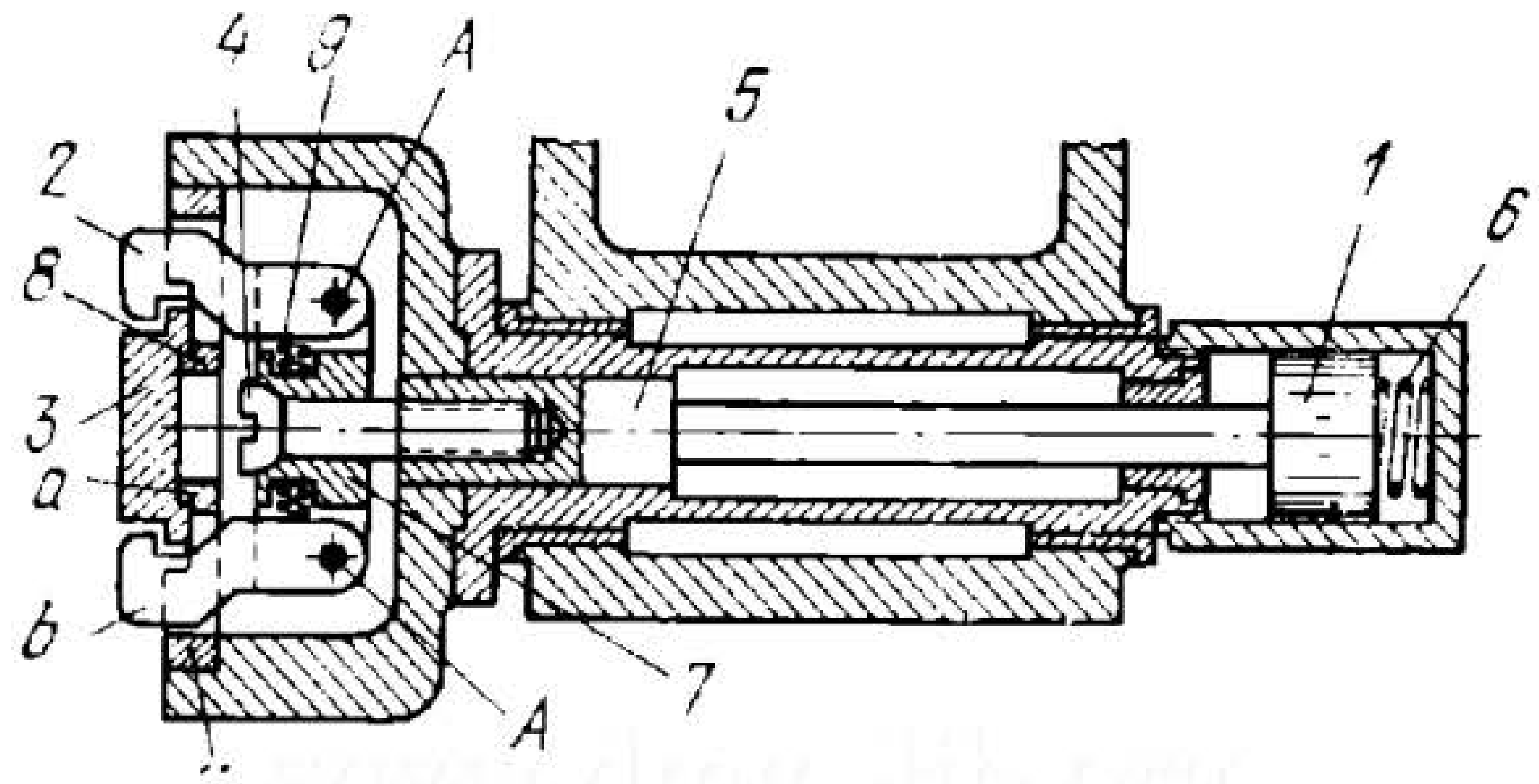


3866	LEVER MECHANISM OF A HYDRAULIC EXTERNAL CLAMPING DEVICE	LHP GC



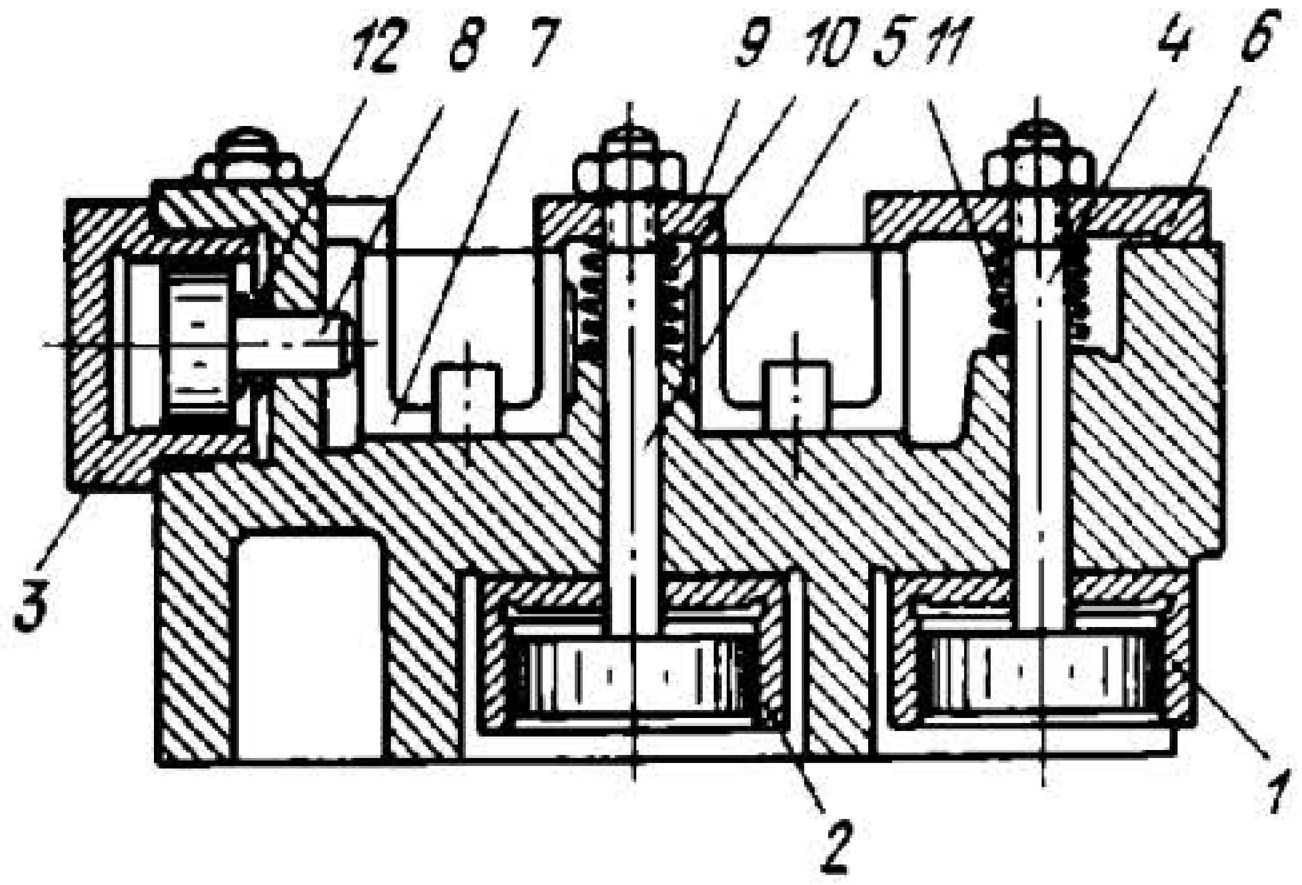
Workpiece *3*, located by shoulder *a*, is clamped by its external flange with two clamping members *2* having slots for the rounded ends of rocker arm *4*. Rocker arm *4* is connected by turning pair *A* to rod *5* of piston *1*. When piston *1* is moved to the right by the action of fluid delivered to the left end of the cylinder, workpiece *3* is clamped against the locating end face. The workpiece is released and clamping members *2* are turned to allow it to be removed when piston *1* is moved to the left by spring *6*.

3867	LEVER MECHANISM OF A HYDRAULIC EXTERNAL CLAMPING DEVICE	LHP GC



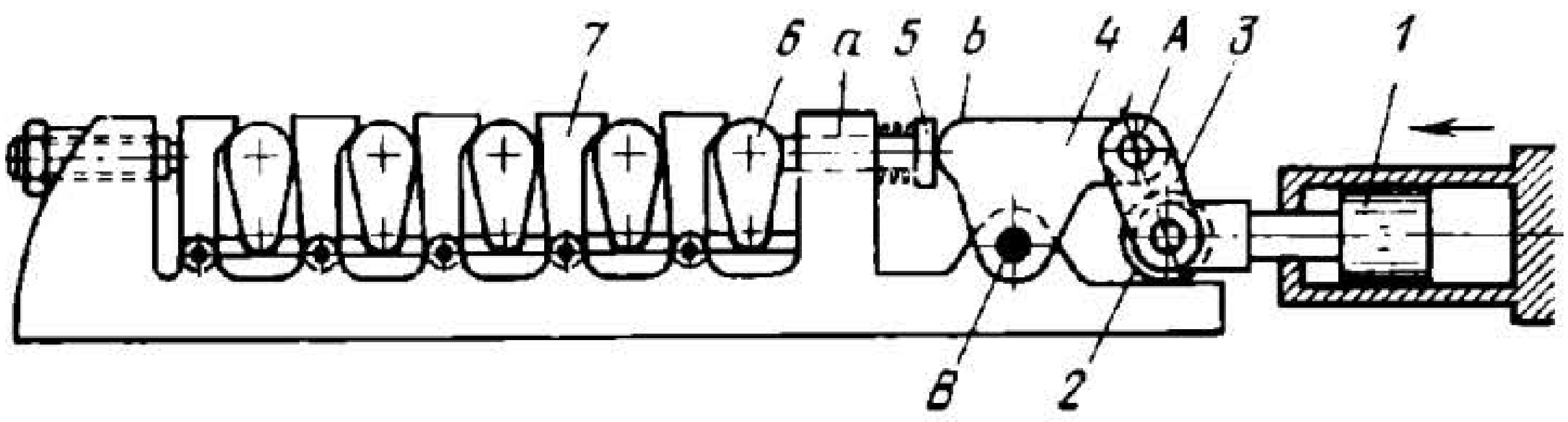
Workpiece *3*, located by shoulder *a*, is clamped by its external flange with three levers *2* (only two are shown) which are connected by turning pairs *A* to link *7* whose spherical recess bears against the spherical head of bolt *4*. Bolt *4* is screwed into rod *5* of piston *1*. When piston *1* is moved to the right by the action of fluid delivered to the left end of the cylinder, workpiece *3* is clamped against locating flange *8*. The workpiece is released when piston *1* is moved to the left by spring *6*. Levers *2* are retracted to enable the workpiece to be removed by springs *9* when the front ends *b* of the levers have been extended well beyond ring 7.

3868	LEVER MECHANISM OF A HYDRAULIC MULTIPLE-CYLINDER CLAMPING DEVICE	LHP GC



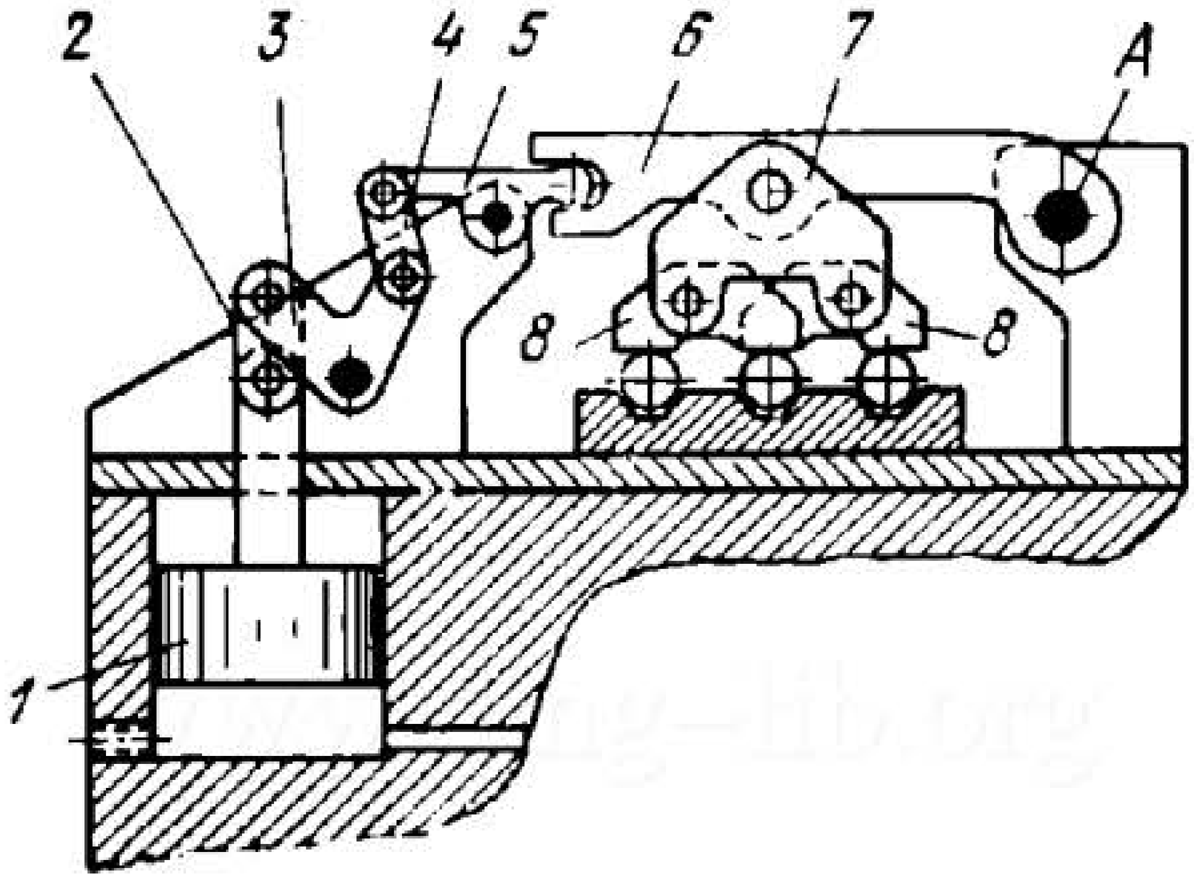
When fluid is delivered into the upper ends of cylinders *1* and *2*, and into the left end of cylinder *3*, rods *4* and *5* clamp workpieces 7 by means of strap clamps *6* and *9*. Rod *8* clamps a workpiece directly. The workpieces are clamped in two perpendicular planes. The workpieces are released, rods *4* and *5*, strap clamps *6* and *9*, and the pistons are raised by springs *11* and *10*. Rod *8* and its piston are retracted by spring *12*.

3869	LEVER-CAM MECHANISM OF A HYDRAULIC MULTIPLE CLAMPING DEVICE	LHP GC



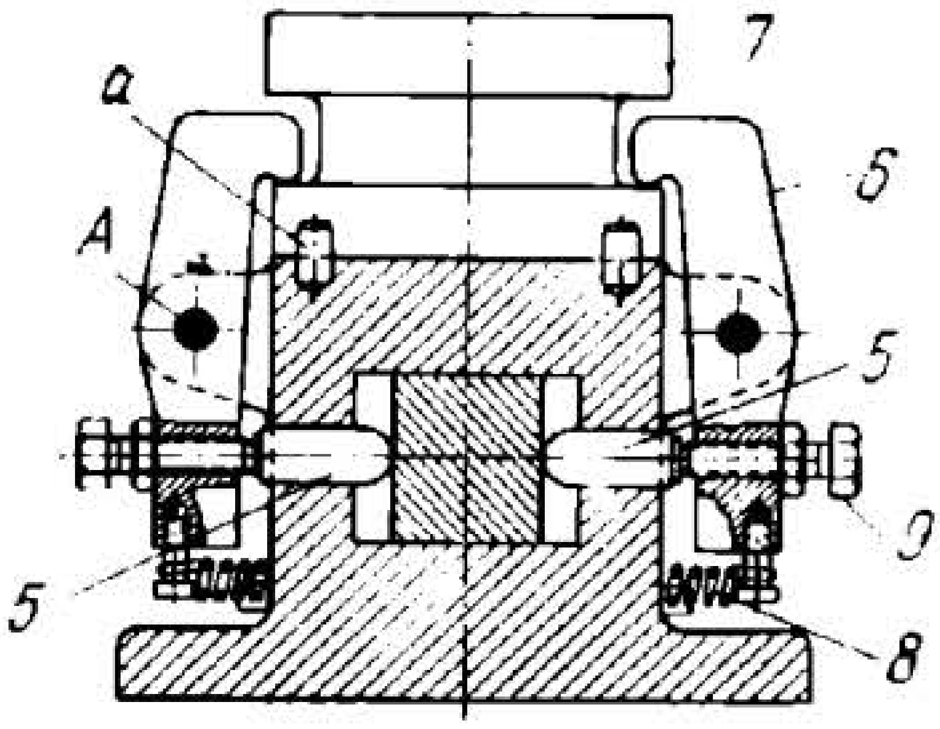
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, motion is transmitted through roller *2*, mounted in the piston rod, and link *3*, connected by turning pair *A* to lever *4*. Lever *4* turns about fixed axis *B* and exerts pressure with its profiled lug *b* on plunger *5*, moving it to the left in guide *a* so that it clamps several workpieces *6*. Each workpiece is also pressed downward by a bevelled swivelling member *7*. The workpieces are released in the return stroke of piston *1* when fluid is delivered to the left end of the cylinder.

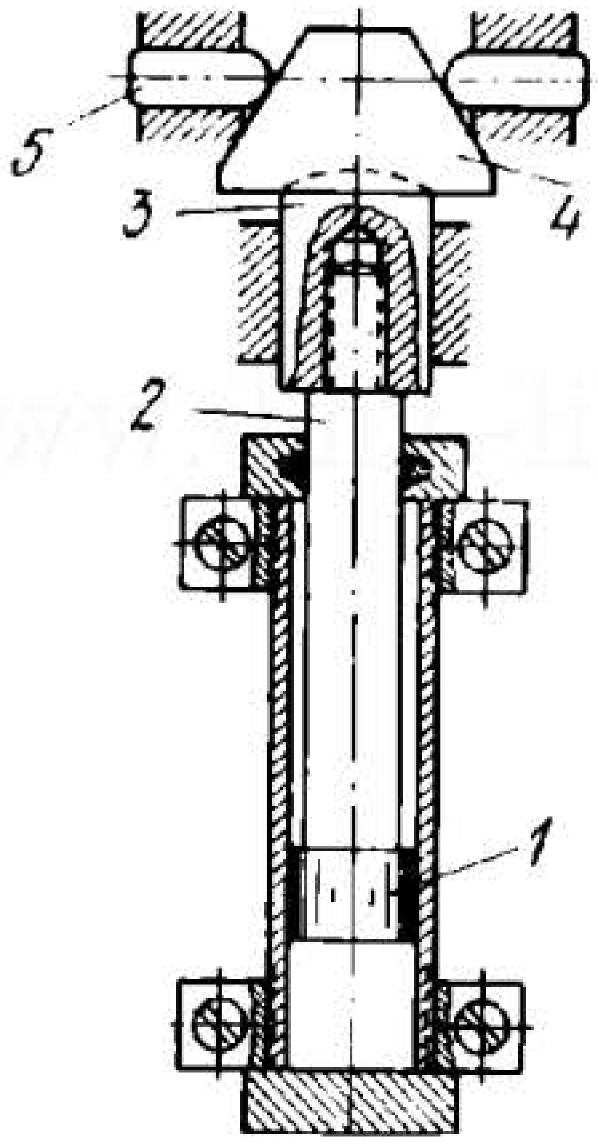
3870	LEVER MECHANISM OF A HYDRAULIC MULTIPLE CLAMPING DEVICE	LHP GC



When piston *1* is moved downward by the action of fluid delivered to the top end of the cylinder, motion is transmitted through levers *2*, *3*, *4* and *5* to clamping lever *6* which turns about fixed axis *A*. This clamps the workpieces in V-blocks by a system of rocker clamps *7* and *8*. Each clamp *8* clamps two adjacent workpieces at three points. The workpieces are released in the return stroke of piston *1* when fluid is delivered to the bottom end of the cylinder.

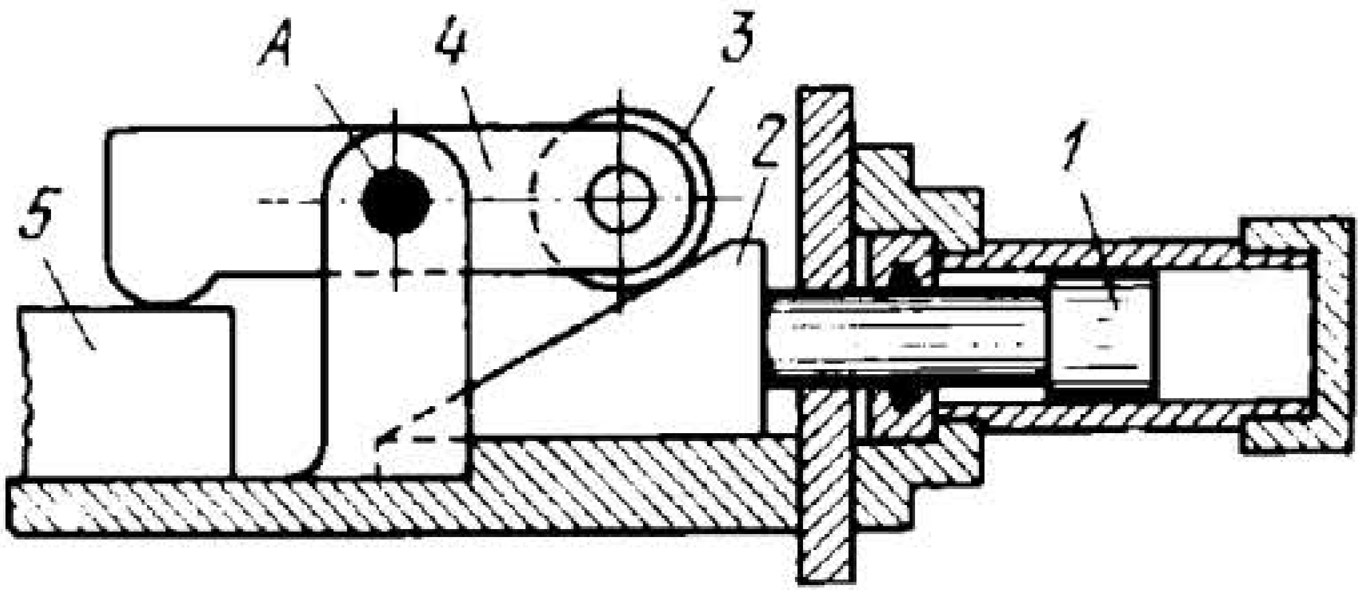
3871	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC





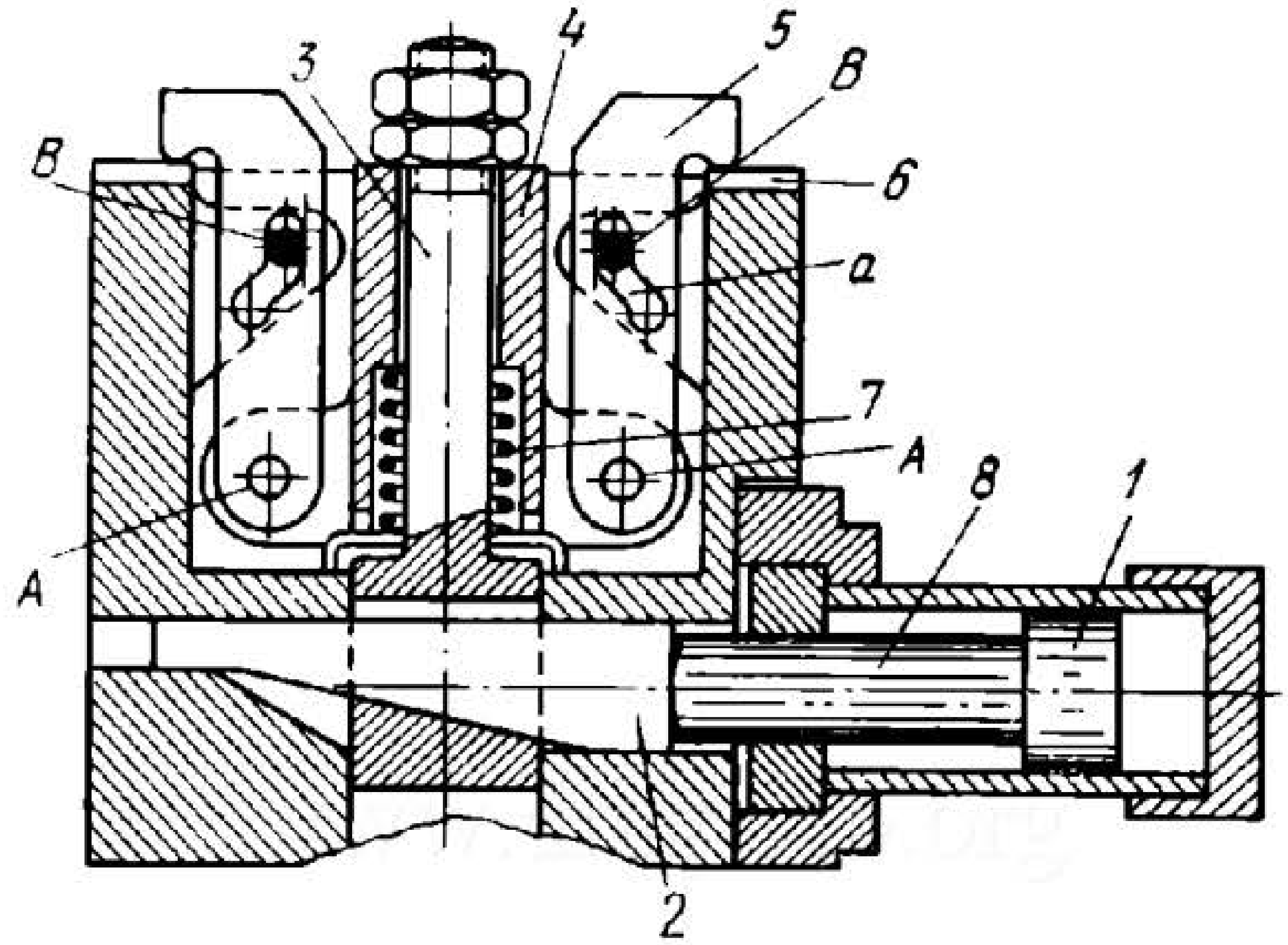
When piston *1* is moved forward by the action of fluid delivered to the other end of the cylinder, its rod *2*, with spherical member *3*, pushes wedge member *4* which spreads two plungers *5*. Plungers *5* turn levers *6* about fixed axes *A*, clamping workpiece *7* which is located by two pins *a*. In the return stroke of piston *1*, levers *6* are returned to their initial position by springs *8* and release workpiece *7*. Adjusting screws *9* are provided to compensate for large variations in thickness of the workpiece.

3872	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



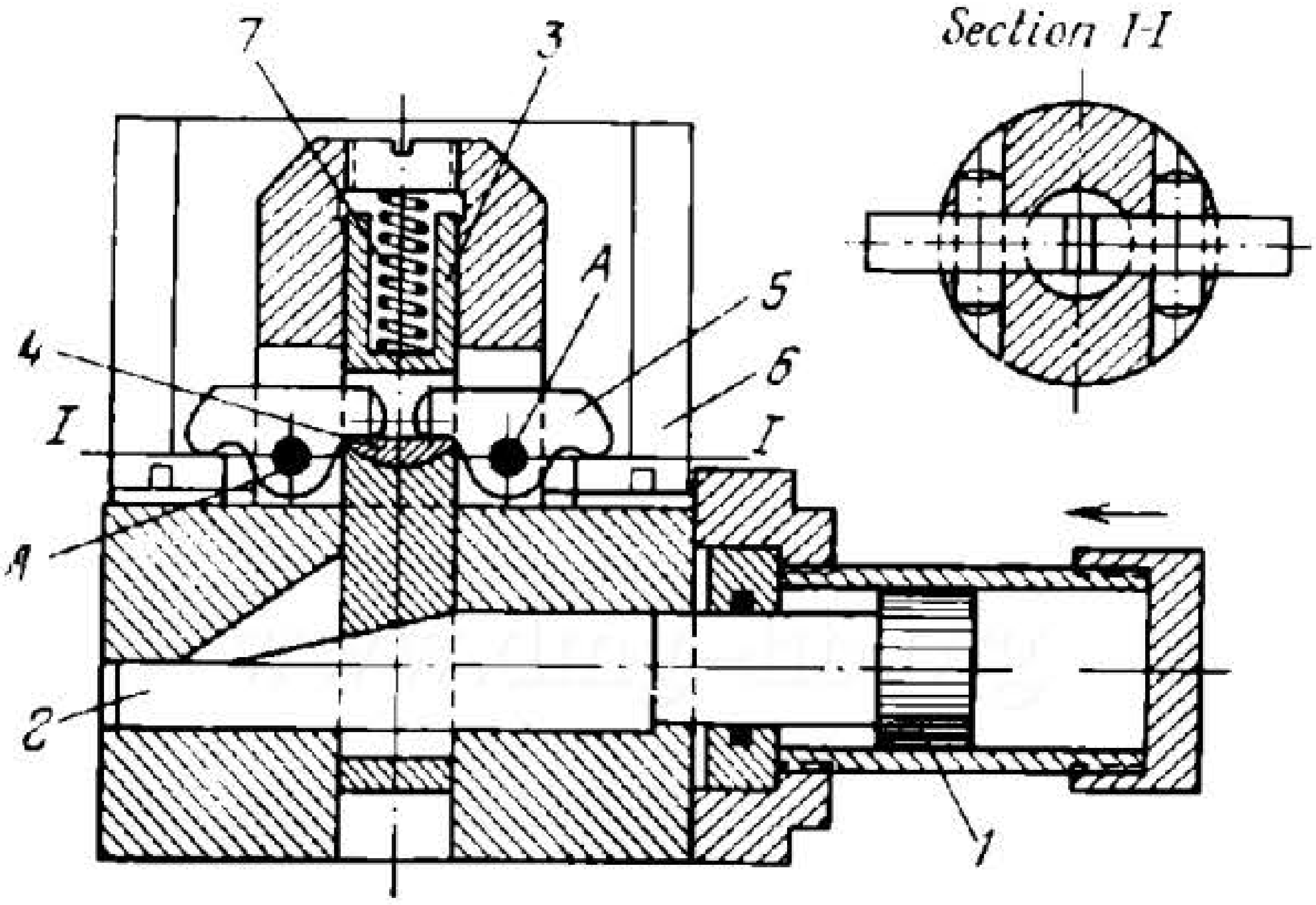
When piston 1 is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge 2, mounted rigidly on the end of the piston rod, actuates roller 3. This turns lever 4 about fixed axis A to clamp workpiece 5. Workpiece 5 is released in the return stroke of piston 1 to the right when fluid is delivered to the left end of the cylinder.

3873	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



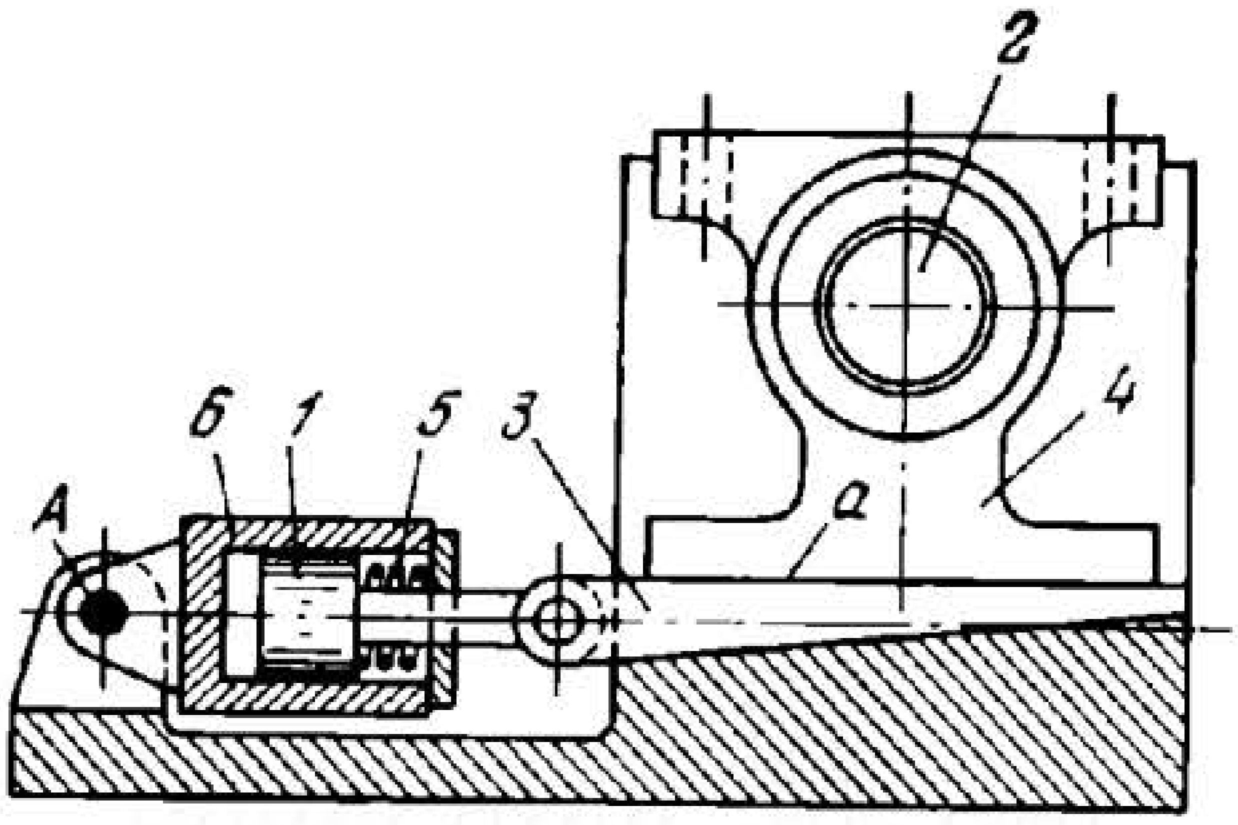
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge *2*, mounted rigidly on the end of the piston rod, pulls clamping bolt *3* downward. Motion is transmitted further to sleeve *4*, connected by turning pairs *A* to levers *5* which turn about and slide along pins at fixed axes *B*. Levers *5* clamp workpiece *6*. The workpiece is released and levers *5* are retracted by spring *7* after wedge *2* is moved to the right when fluid is delivered to the left end of the cylinder. Levers *5* are retracted by their profiled slots *a* which slide along the pins at axes *B*.

3874	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



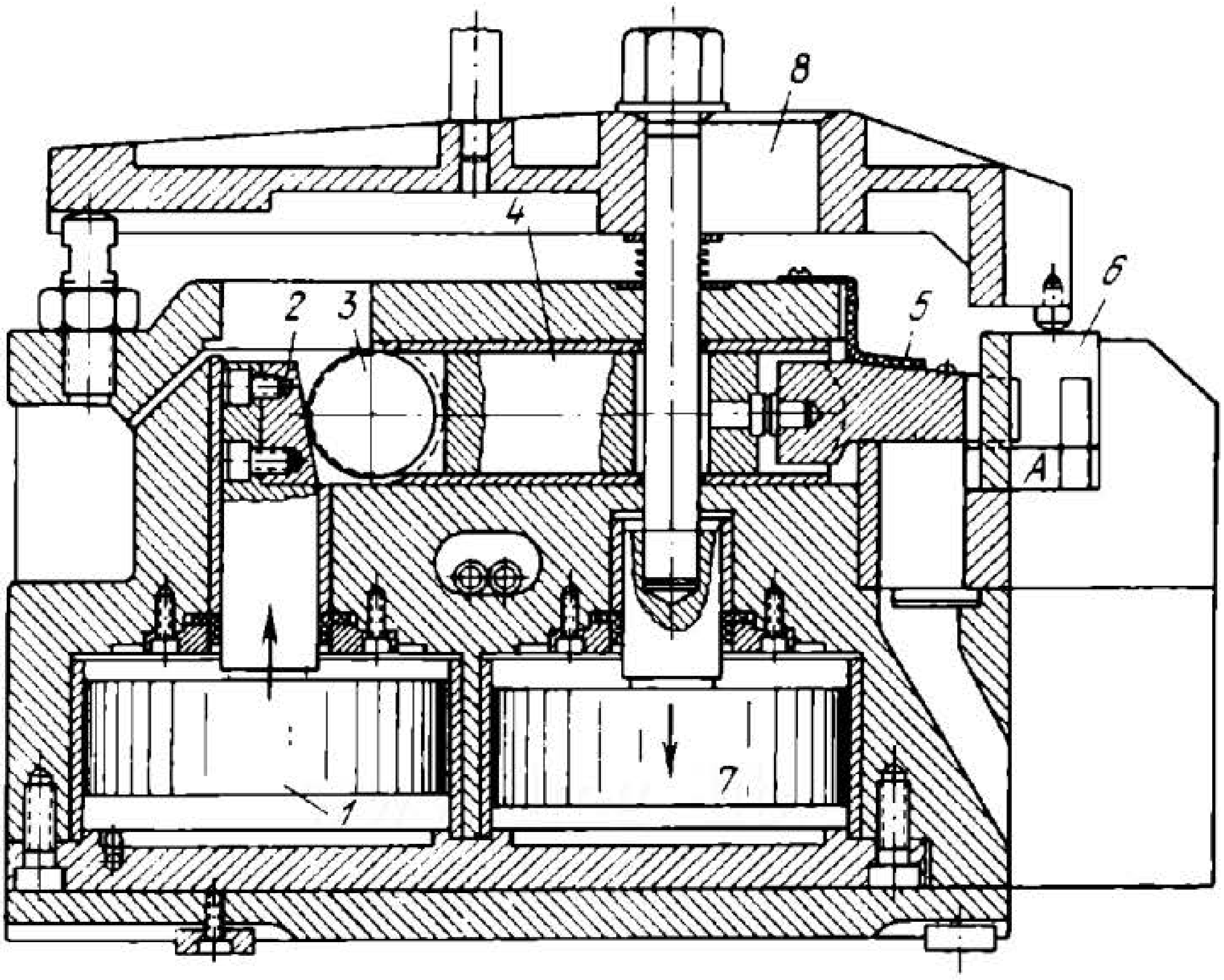
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge *2*, mounted rigidly on the end of the piston rod, pushes plunger *3* upward. At this, spherical washer *4* turns levers *5* about fixed axes *A* to clamp workpiece *6*, located on pins, by its inner flange. Workpiece *6* is released and levers *5* are retracted when piston *1* is moved to the right by fluid delivered to the left end of the cylinder. Plunger *3* and two levers *5* are returned to the initial position by spring 7.

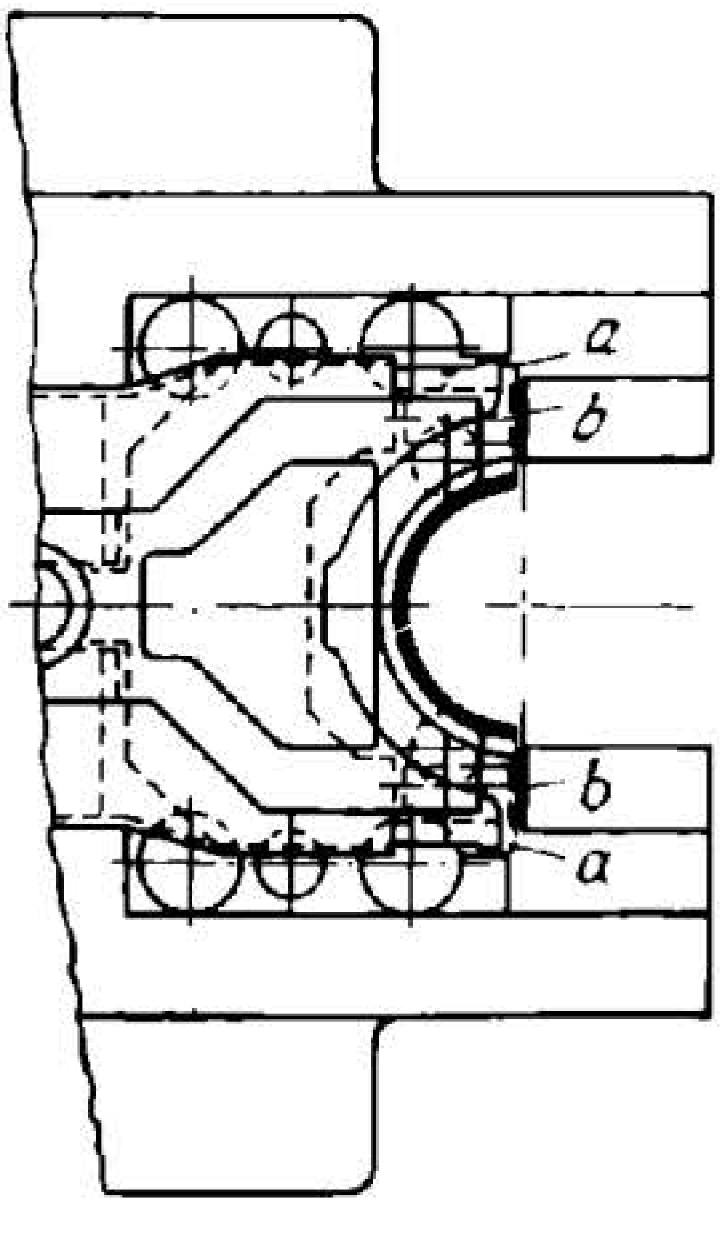
3875	WEDGE-LEVER MECHANISM OF A SWIVELLING-CYLINDER HYDRAULIC CLAMPING DEVICE	LHP GC



Workpiece *4* is located with its bore on pin *2* and is set in the horizontal position by surface *a* of wedge *3* which slides in an inclined slot in the body of the device. Wedge *3* is connected by a turning pair to the rod of piston *1* which is moved to the right by the action of fluid delivered to the left end of cylinder *6*. Cylinder *6* turns about fixed axis *A*. When piston *1* is moved to the left by spring *5*, it moves wedge *3* to the left, releasing workpiece *4*.

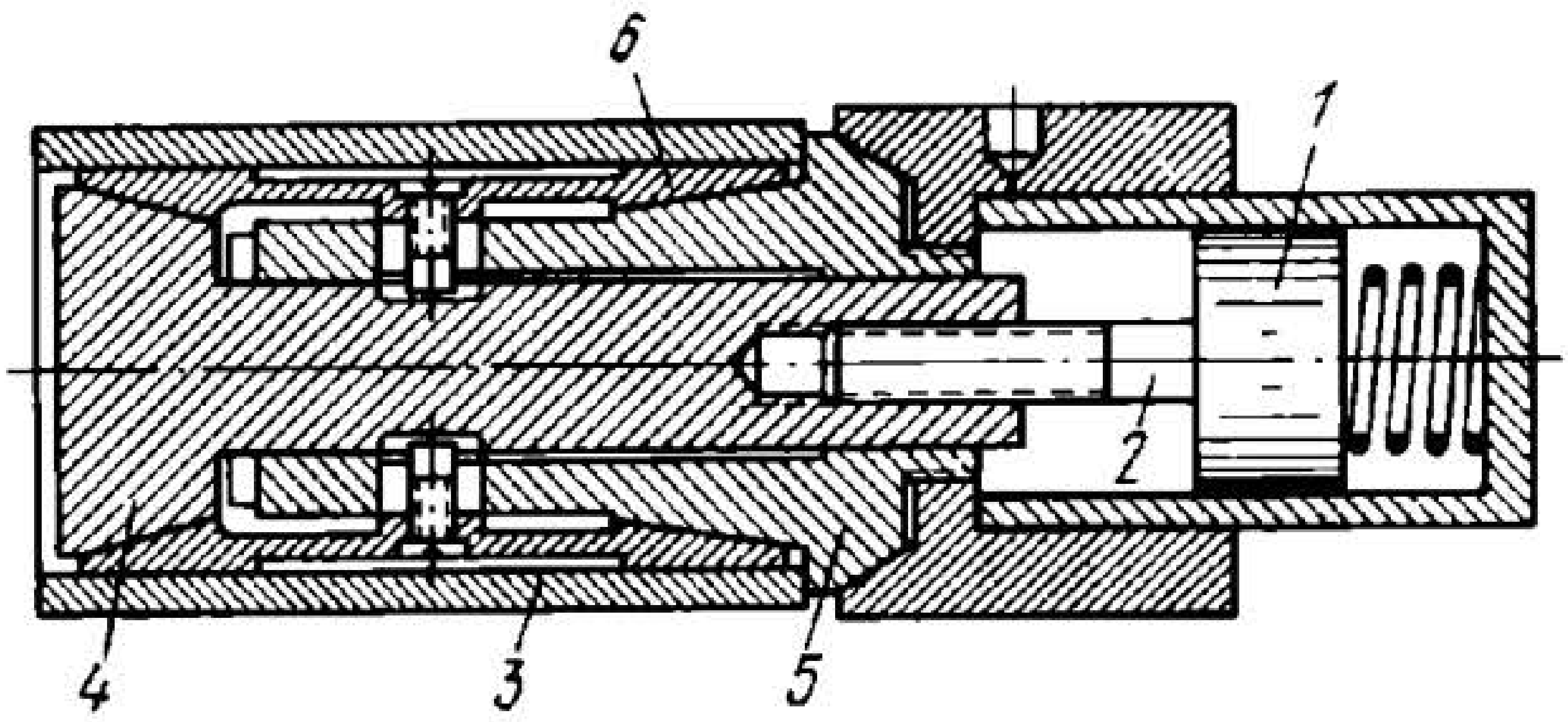
3876	WEDGE MECHANISM OF A HYDRAULIC CLAMPING DEVICE WITH A ROCKING MEMBER	LHP GC





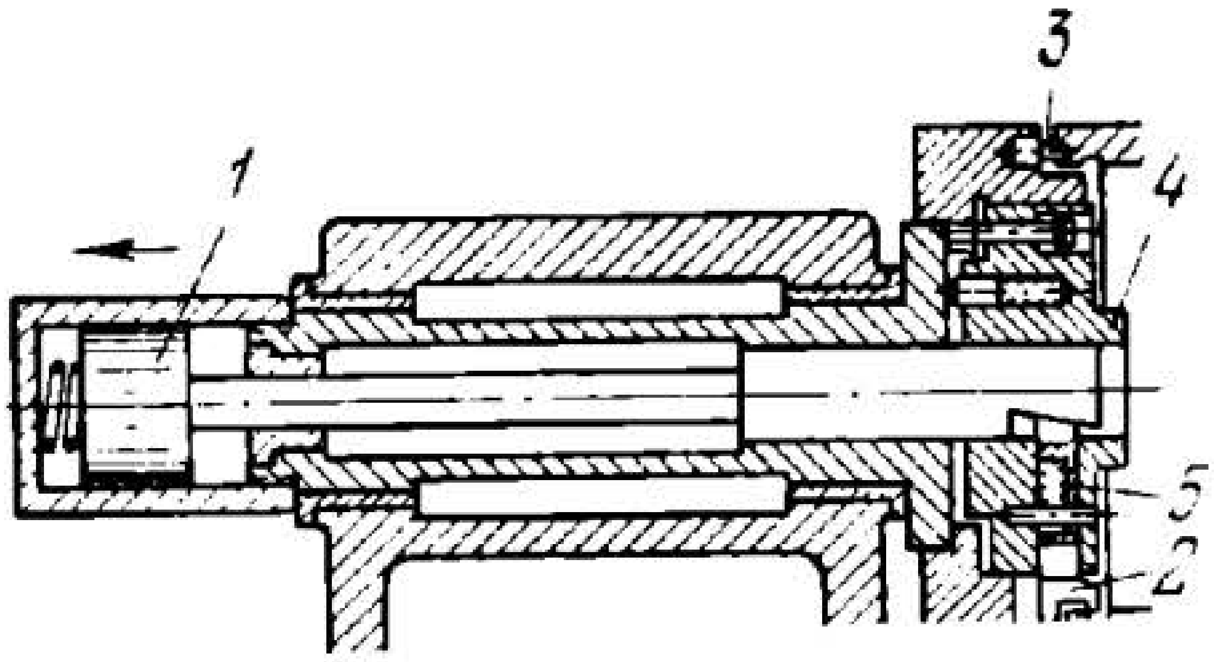
When piston *1* is moved upward by the action of fluid delivered to the bottom end of the cylinder, wedge *2*, rigidly mounted on the piston rod, pushes roller *3* and plunger *4* to the right. Pivoted on plunger *4* is rocking member *5* which locates workpiece *6* on its two datum surfaces *a* and *b*. After this, piston *7* is moved downward by the action of fluid delivered to the top end of its cylinder, pulling down a tie bolt, attached to the piston rod, and clamp *8* which clamps workpiece *6* against a horizontal locating surface. Workpiece *6* is released in the return strokes of pistons *1* and 7.

3377	WEDGE MECHANISM OF A HYDRAULIC EXPANDING MANDREL	LHP GC



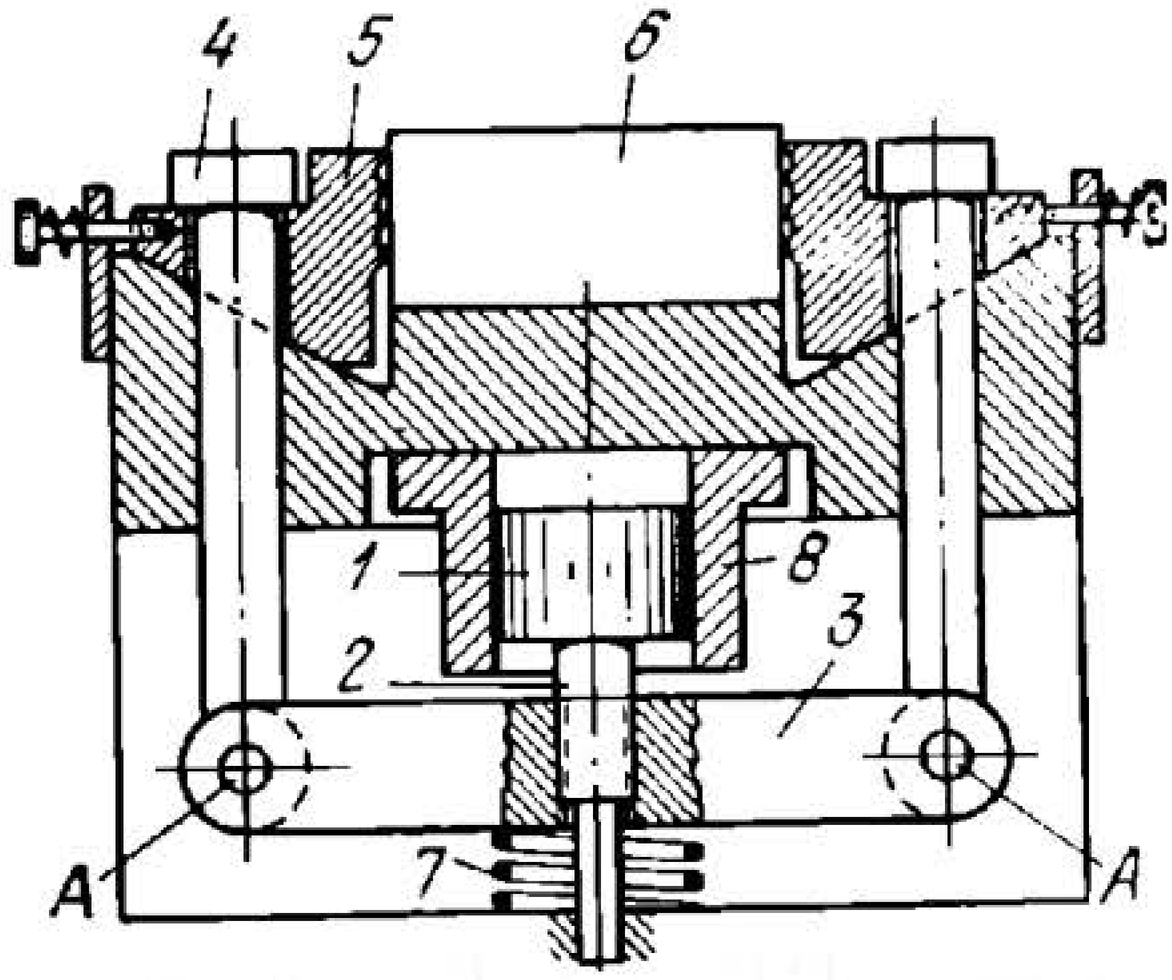
When piston *1* is moved to the right by the action of fluid delivered to the left end of the cylinder, draw rod *2*, by means of tapered members *4* and *5*, expands slotted spring sleeve *6* to locate and clamp thin-walled workpiece *3* on its previously machined bore. Sleeve *6* is of the spring collet type with alternating slits cut from the two ends to enable it to be expanded.

3878	WEDGE MECHANISM OF A HYDRAULIC CHUCK	LHP GC



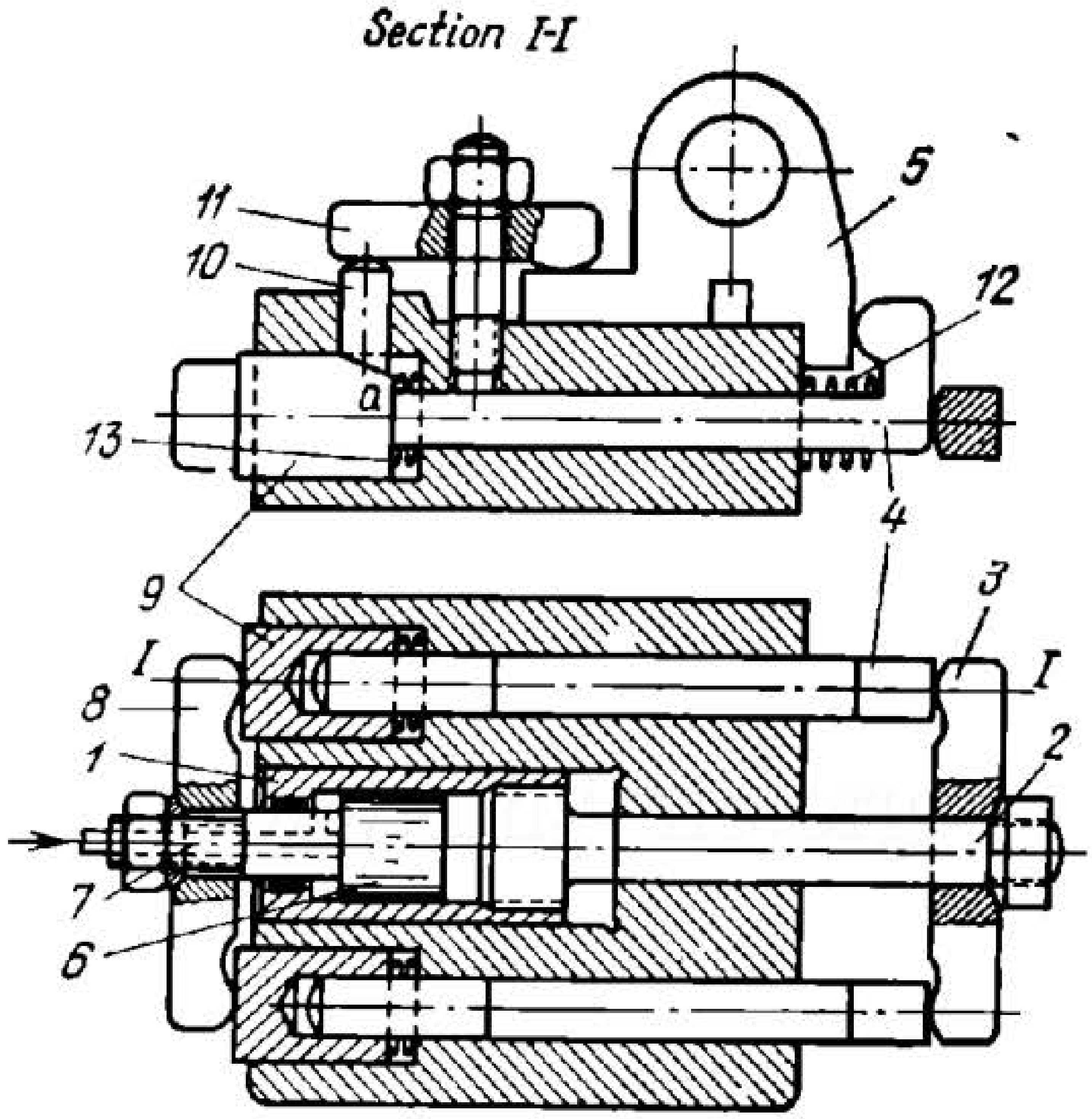
When piston *1* is moved to the left by fluid delivered to the right end of the cylinder, its rod spreads plungers *2* radially outward, clamping a workpiece by its shoulder against the end face of the chuck. The workpiece is located on two holes by pins *3*. Six plungers *2*, sliding in radial holes machined in floating ring *4*, are retracted to the centre by springs *5*, releasing the workpiece, when piston *1* is moved by a spring to the right.

3879	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



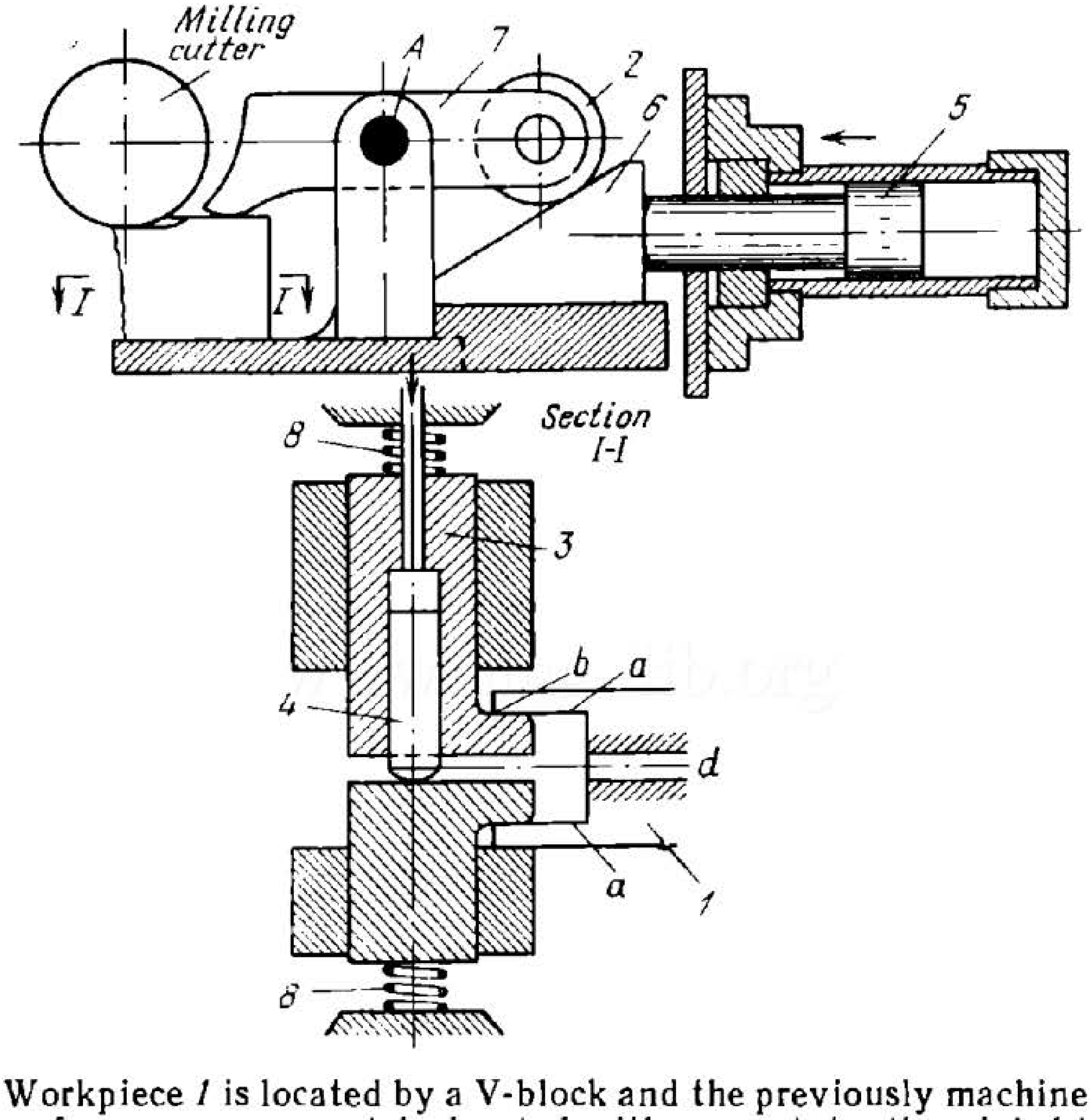
When piston *1* is moved downward by the action of fluid delivered to the top end of cylinder *8*, it pushes crosspiece *3*, rigidly attached to piston rod *2*, downward. Crosspiece *3* is connected by turning pairs *A* to drawbolts *4* which actuate wedge clamps *5*. These clamps slide along inclined surfaces in the body of the device and clamp workpiece *6* in both the horizontal and vertical directions. The workpiece is released in the return stroke of piston *1* by the action of spring *7* which raises crosspiece *3* and drawbolts *4*, and the piston forces the fluid out of cylinder *8* and back into the tank.

3880	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



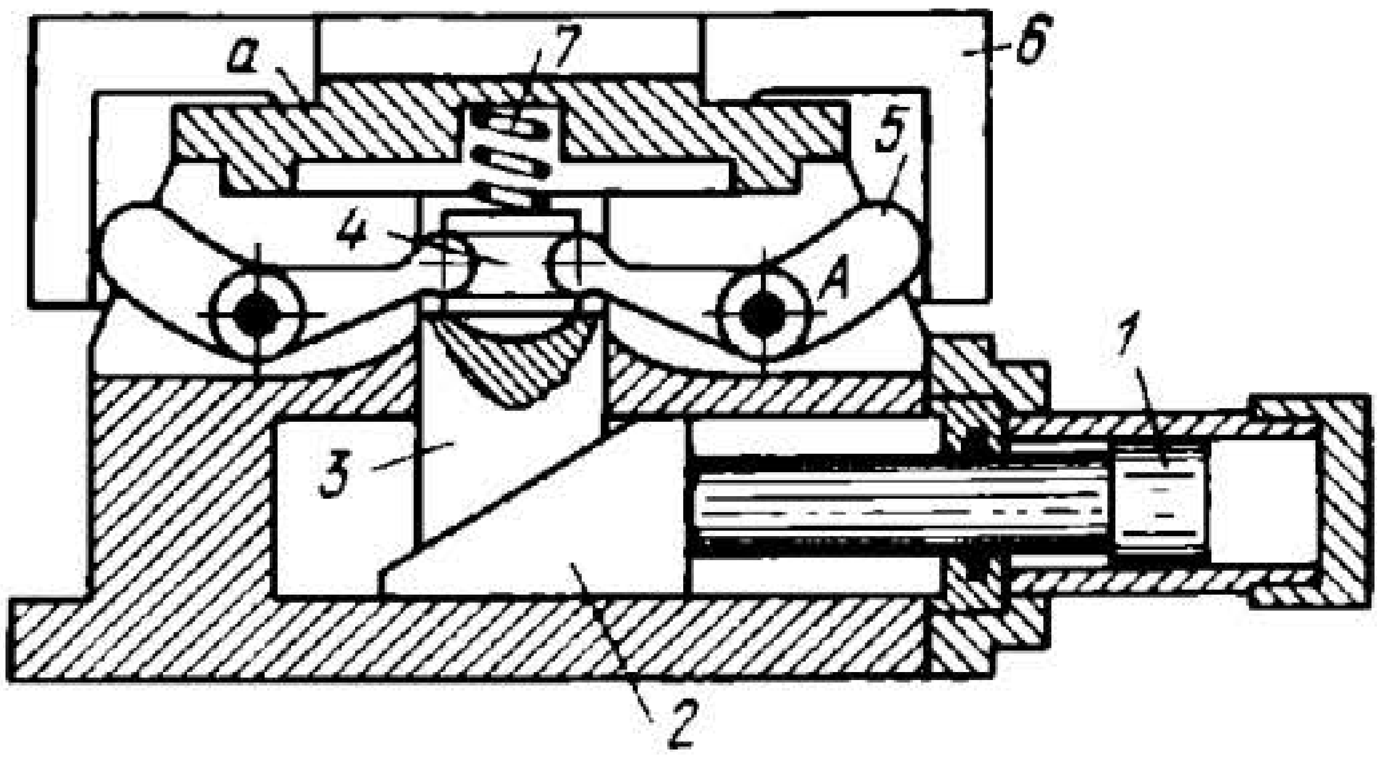
When cylinder *1* is moved to the left by the action of fluid delivered to its left end, draw rod *2* actuates strap *3* which exerts uniform pressure on two gib-headed bolts *4*, clamping workpiece *5* in the horizontal direction. At the same time, piston *6* is moved to the right by the fluid and its rod *7* actuates strap *8* which exerts uniform pressure on two sliders *9*. Bevels *a* of the sliders push plungers *10* upward so that strap clamps *11* clamp the workpiece at two points in the vertical direction. The piston, cylinder and all the members linked to them are returned to the initial position, releasing the workpiece, by springs *12* and *13*. This forces the fluid out of the cylinder back to the tank through a passage in piston rod 7.

3881	WEDGE-LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE WITH FLOATING PLUNGERS	LHP GC



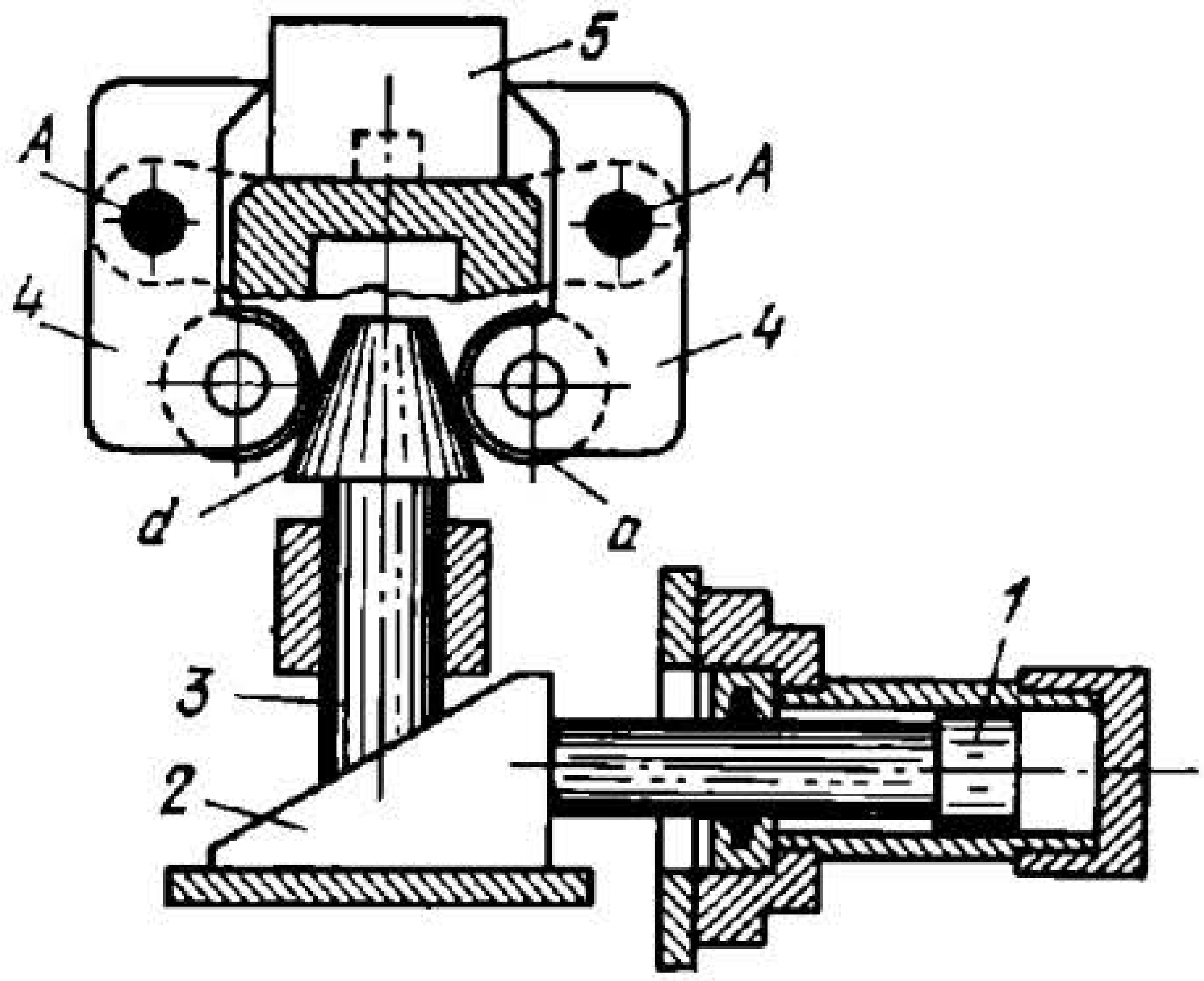
Workpiece *1* is located by a V-block and the previously machined surfaces *a* are accurately located with respect to the slot *d* to be milled. Surfaces *a* are set into the vertical position by two floating plungers *3* which are spread by hydraulic plunger *4*. Locating surfaces *b* of the plungers should be strictly vertical. Workpiece *1* is clamped when piston *5* is moved to the left by fluid delivered to the right end of its cylinder. At this, wedge *6*, rigidly mounted on the end of the piston rod, actuates roller *2* which turns clamp *7* about fixed axis *A* to clamp the workpiece. The workpiece is released in the return strokes of plunger *4* and piston *5*. At this, clamp 7 turns to an angle of 45° and plungers *3* are pushed inward by springs *8*, enabling the workpiece to be removed.

3882	WEDGE-LEVER MECHANISM OF A HYDRAULIC THREE-JAW INTERNAL CLAMPING DEVICE	LHP GC



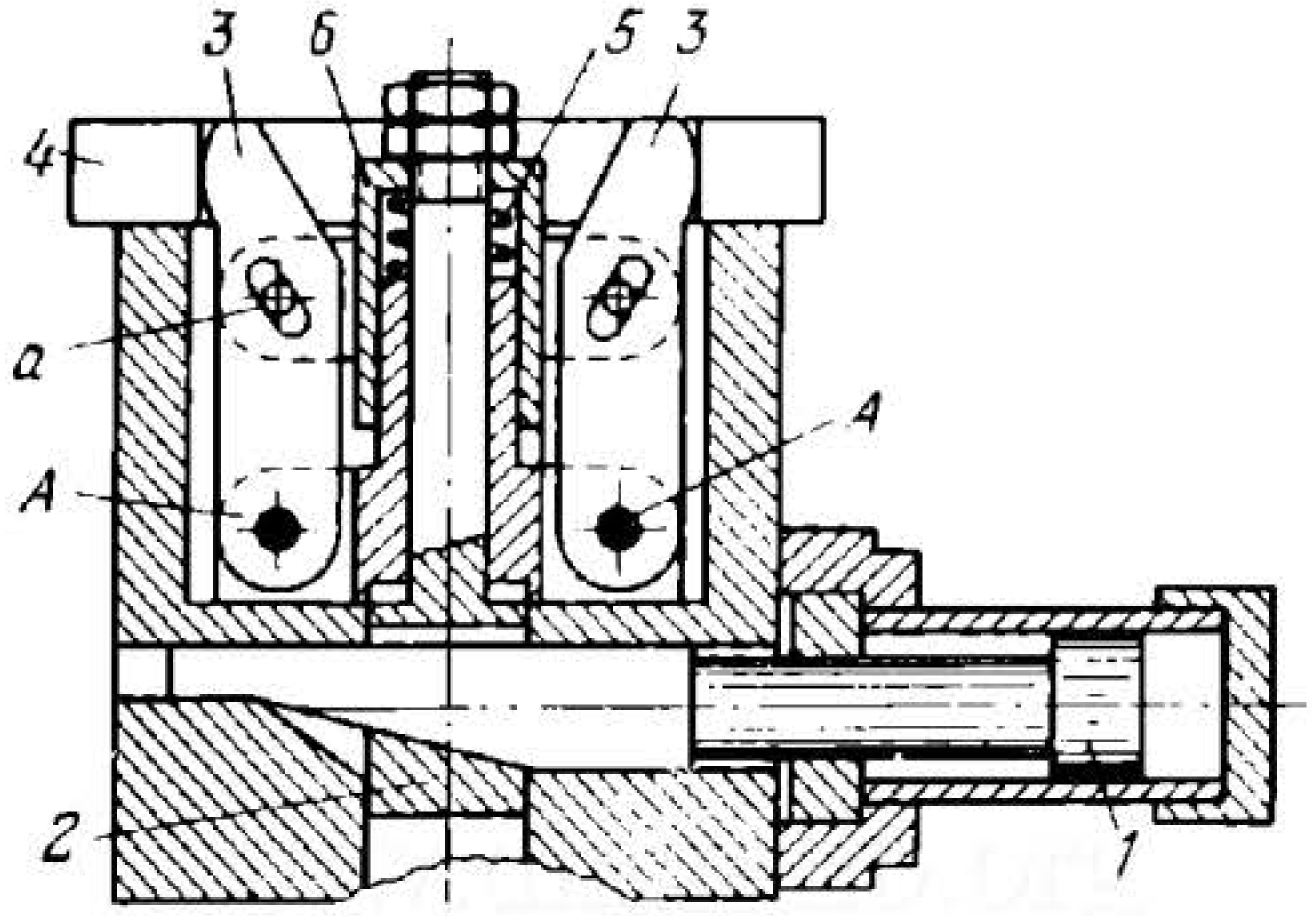
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge *2*, mounted rigidly on the end of the piston rod, pushes wedge *3* upward with spherical member *4*. This turns lever cams *5* about fixed axes *A*, clamping workpiece *6* which is located by shoulder *a*. Cam levers *5* are retracted and the other links are returned to the initial position, releasing the workpiece, by spring *7*. Cam levers *5* are conventionally shown in a single plane. Actually, the three levers are equally spaced at 120° to one another.

3883	WEDGE-LEVER MECHANISM OF A HYDRAULIC SELF-CENTERING CLAMPING DEVICE	LHP GC



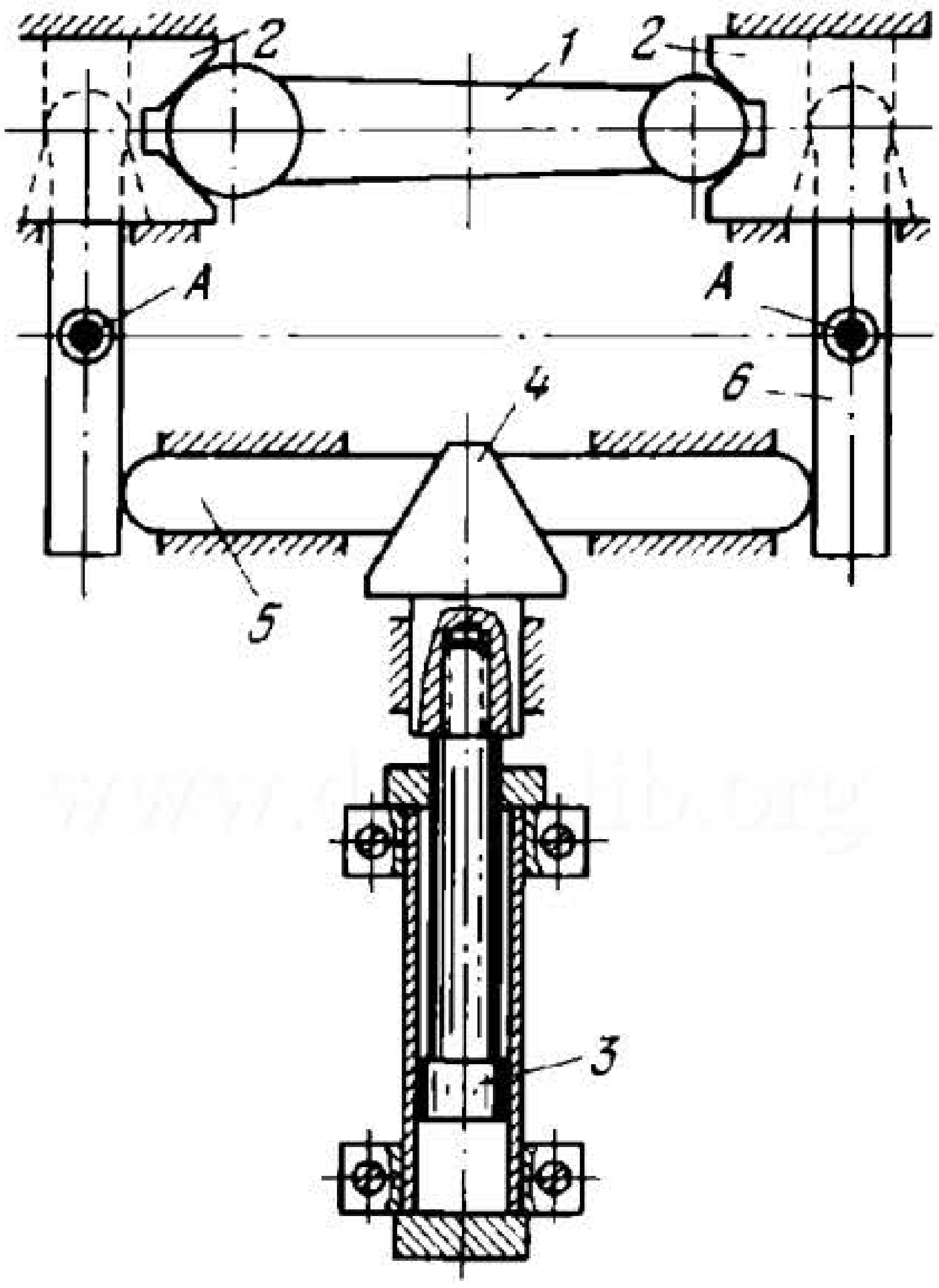
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge *2*, mounted rigidly on the end of the piston rod, pushes member *3* upward. Rollers *a* roll along cone *d* of member *3*, turning levers *4* about fixed axes *A* to locate and clamp workpiece *5*.

3884	WEDGE-LEVER MECHANISM OF A HYDRAULIC SELF-CENTERING CLAMPING DEVICE	LHP GC



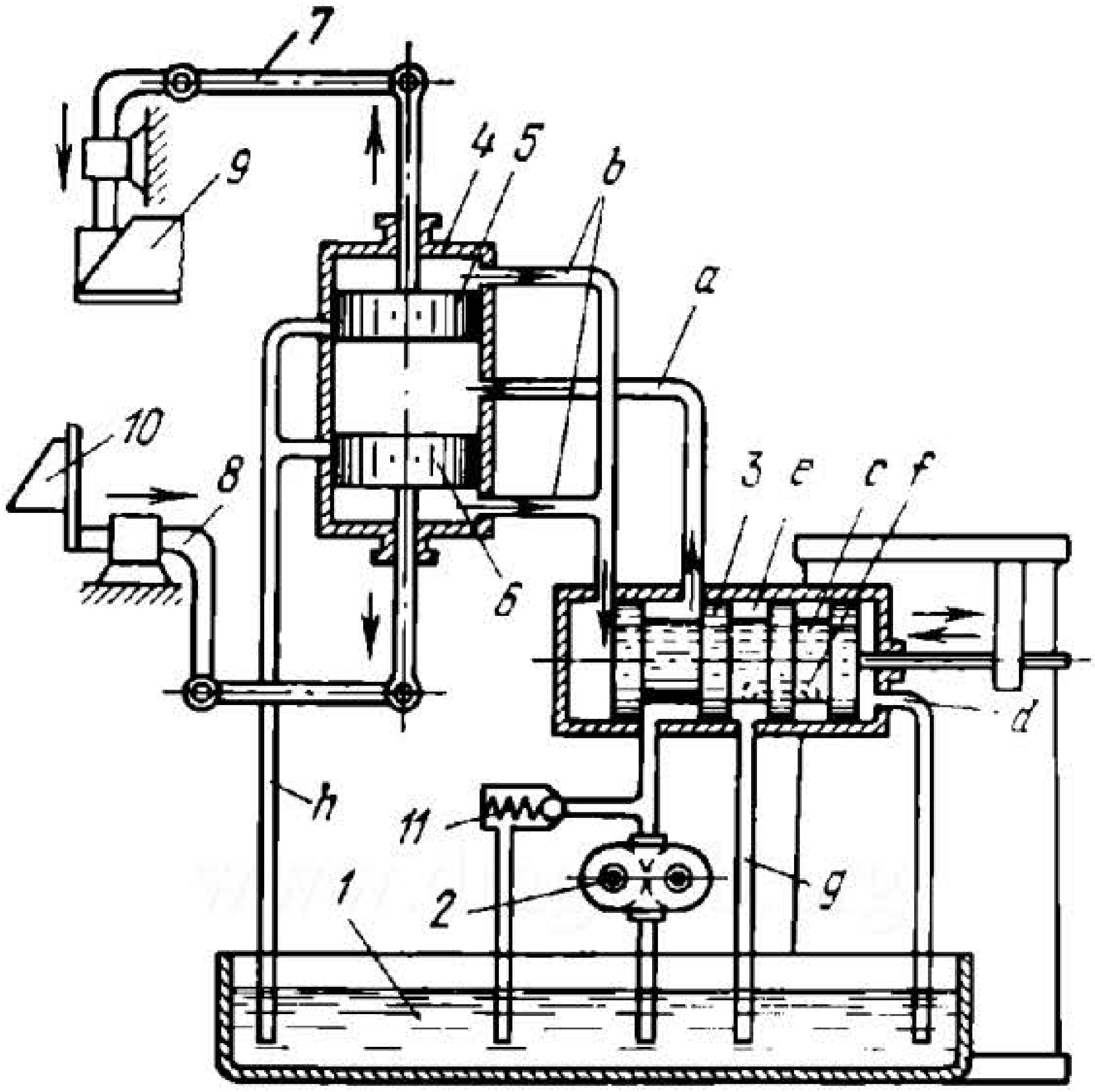
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, draw bolt *2* pulls crosspiece *6* downward. By means of pins *a*, this turns levers *3* about fixed axes *A* to locate and clamp workpiece *4* by its bore. When piston *1* is moved by fluid to the right, spring *5* raises crosspiece *6*, retracting levers *3* and releasing the workpiece. Two levers *3* are conventionally shown. Actually, there are three levers equally spaced at 120° to one another.

3885	WEDGE-LEVER MECHANISM OF A HYDRAULIC SELF-CENTERING CLAMPING DEVICE	LHP GC



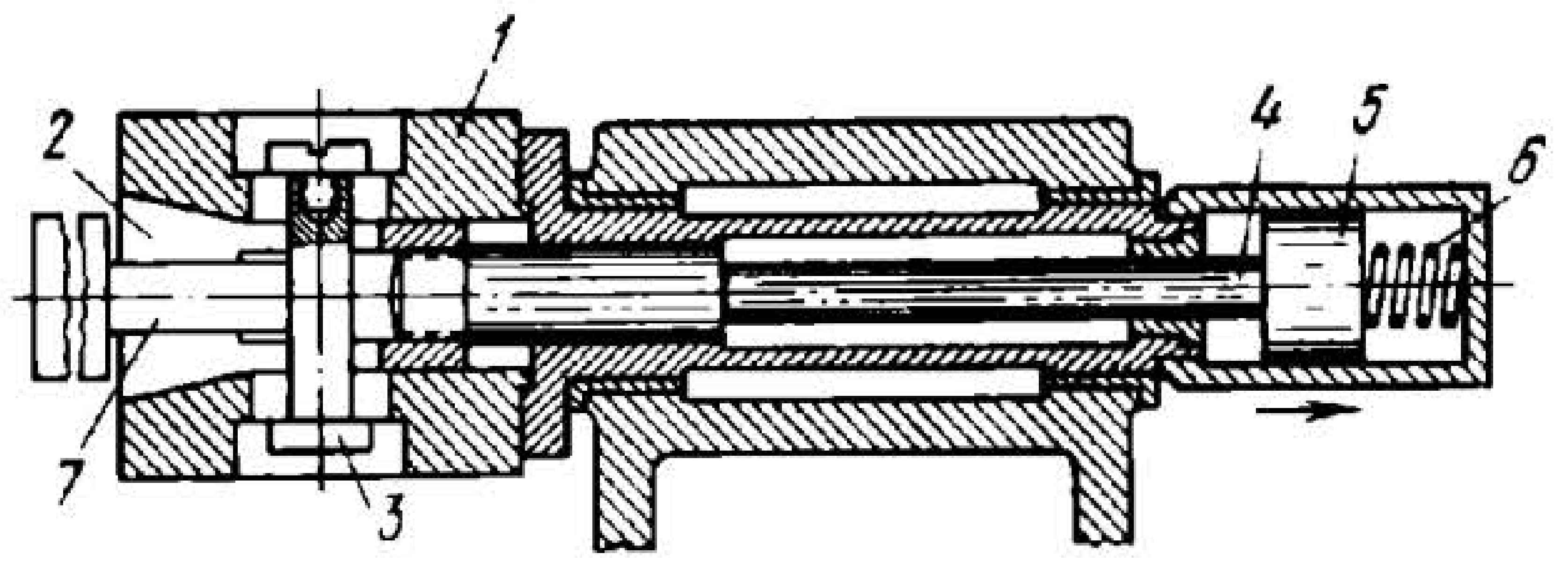
Workpiece 1 is located and clamped by two V-blocks 2 which slide in fixed slots. When piston 3 is moved upward by the action of fluid delivered to the bottom end of the cylinder, conical member 4, mounted rigidly on the piston rod, spreads plungers 5 an equal distance from the centre. Plungers 5 turn levers 6 about fixed axes A. This pushes V-blocks 2 inward to clamp workpiece 1.

3886	LEVER MECHANISM OF A HYDRAULIC CLAMPING DEVICE	LHP GC



Fluid is delivered by pump *2* at constant pressure from tank *1* to directional valve *3* and along pipeline *a* to the middle space of cylinder *4* (between pistons *5* and *6*). By the action of the fluid, pistons *5* and *6* are moved upward and downward, and, by means of levers 7 and *8*, the stock is clamped by vertical and horizontal jaws *9* and *10*. Fluid, forced out of the top and bottom ends of cylinder *4*, drains back to tank *1* through pipelines *b*, channel *c* and pipeline *d*. When the spool of valve *3* is shifted to the left, fluid is delivered through pipelines *b* to the top and bottom ends of cylinder *4*. This moves pistons *5* and *6* toward each other and jaws *9* and *10* release the stock. Fluid, forced out of the middle space of cylinder *4*, drains back to tank *1* through pipeline *a*, groove *e*, channel *f* and pipeline *g*. When pistons *5* and *6* approach each other, fluid delivered by the pump drains to tank *1* through pipeline *h*. Relief valve *11* allows surplus fluid to drain back to the tank.

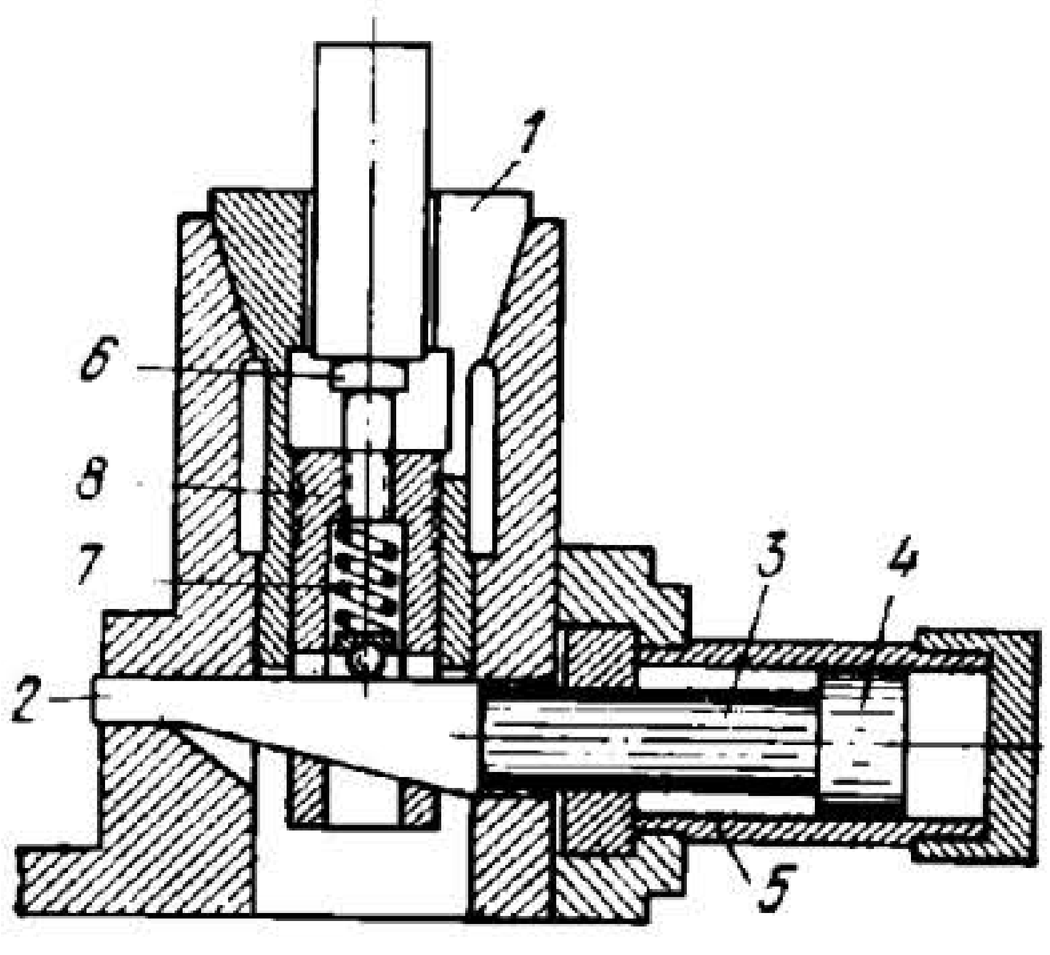
3887	WEDGE MECHANISM OF A HYDRAULIC COLLET CHUCK	LHP GC



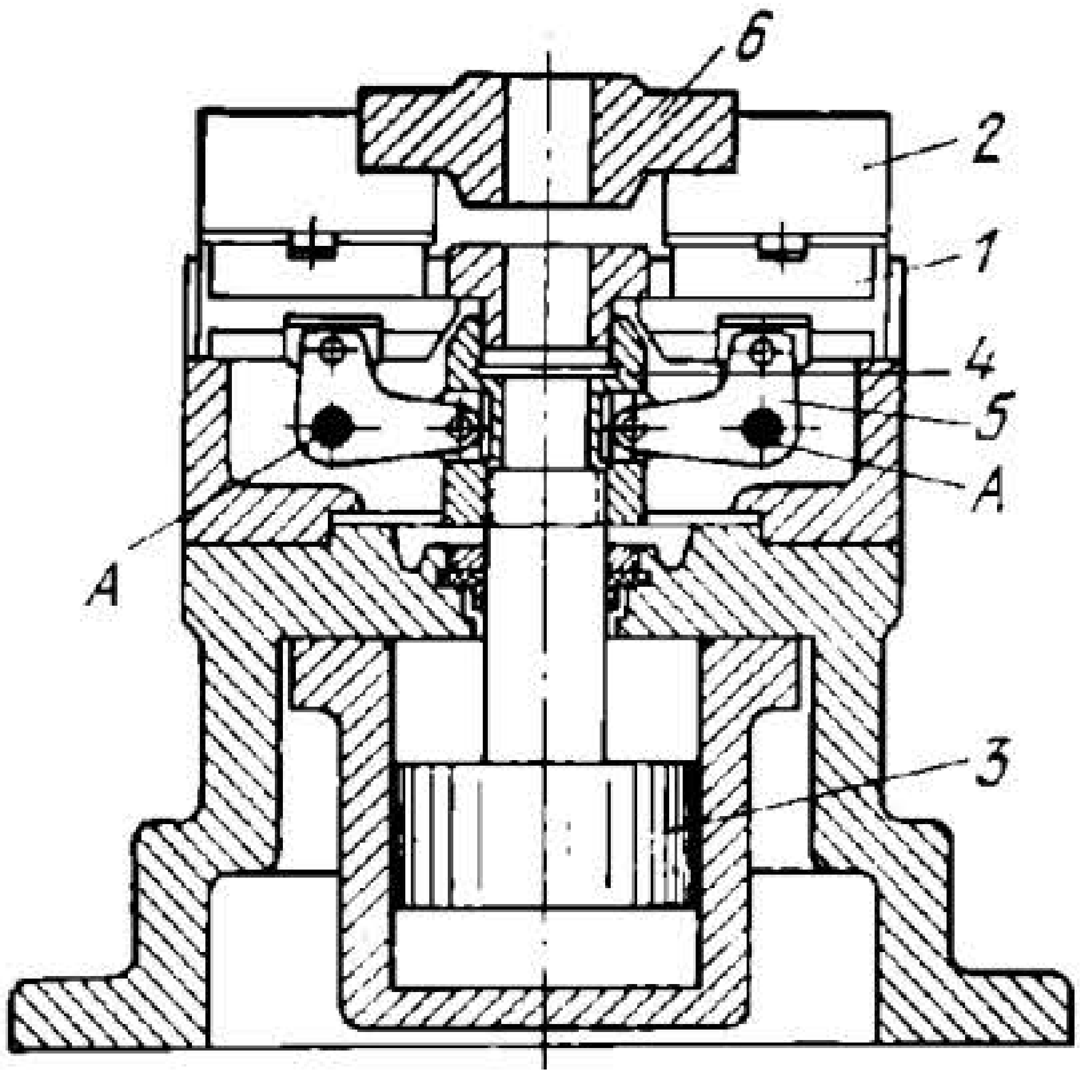
Collet chuck *1*, intended for clamping cylindrical workpieces of various lengths, has adjustable stop *3* passing through a slot of split collet *2*. Collet *2* is attached to piston rod *4*. When piston *5* is moved to the right by the action of fluid delivered to the left end of the cylinder, workpiece *7* is clamped. It is released when piston *5* is moved to the left by spring *6*.

3888	WEDGE MECHANISM OF A HYDRAULIC COLLET CHUCK	LHP GC

Collet *1*, serving to locate and clamp the workpiece by its external cylindrical surface, is actuated by wedge *2* which is mounted rigidly on piston rod *3*. When piston *4* is moved to the left by the action of fluid delivered to the right end of cylinder *5*, the workpiece is clamped. Adjustable stop *6* locates the workpiece in height. Spring *7*, bearing against sleeve *8* which is screwed into collet *1*, pushes the collet to its upper position when piston *4* is moved to the right by fluid delivered to the left end of cylinder *5*.

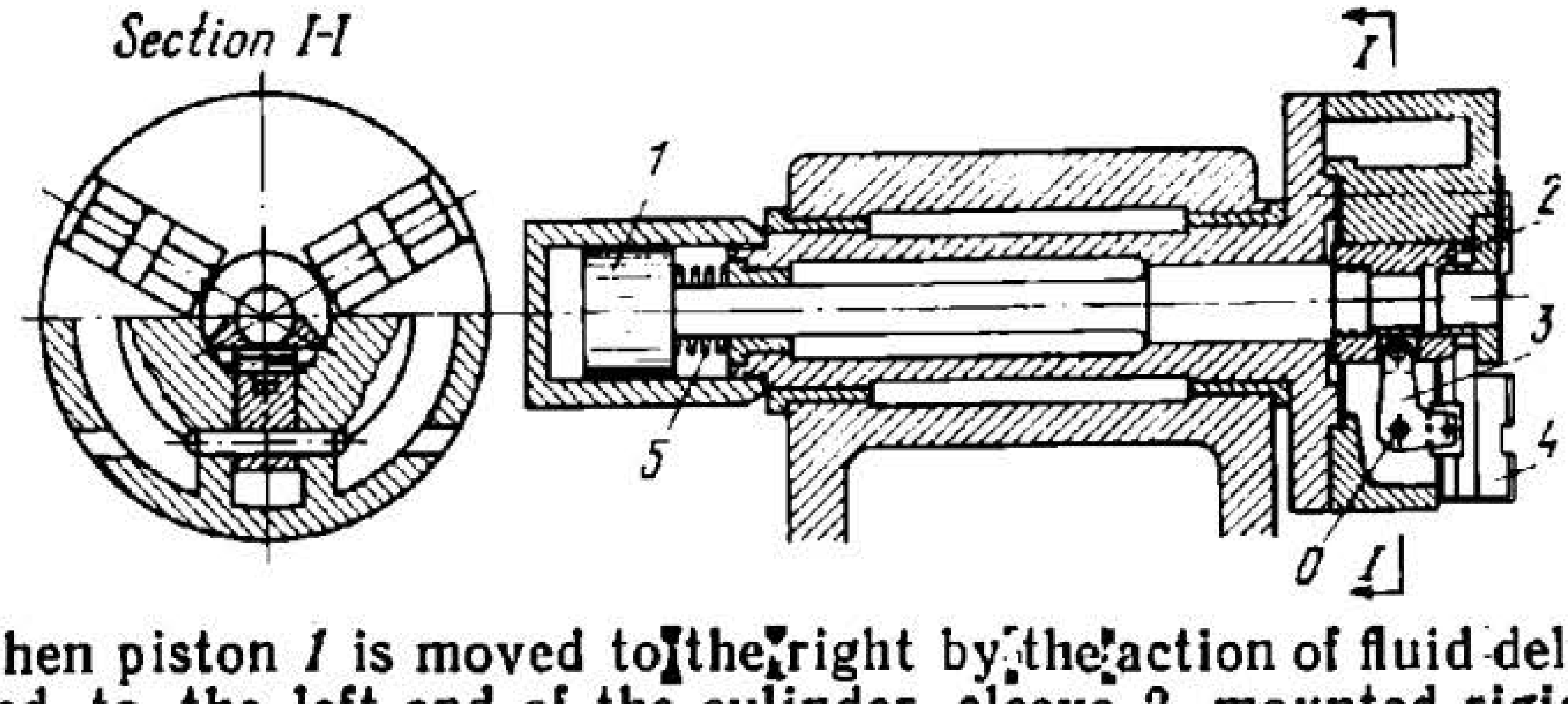


3889	LEVER-CAM MECHANISM OF A HYDRAULIC THREE-JAW SELF-CENTERING CHUCK	LHP GC



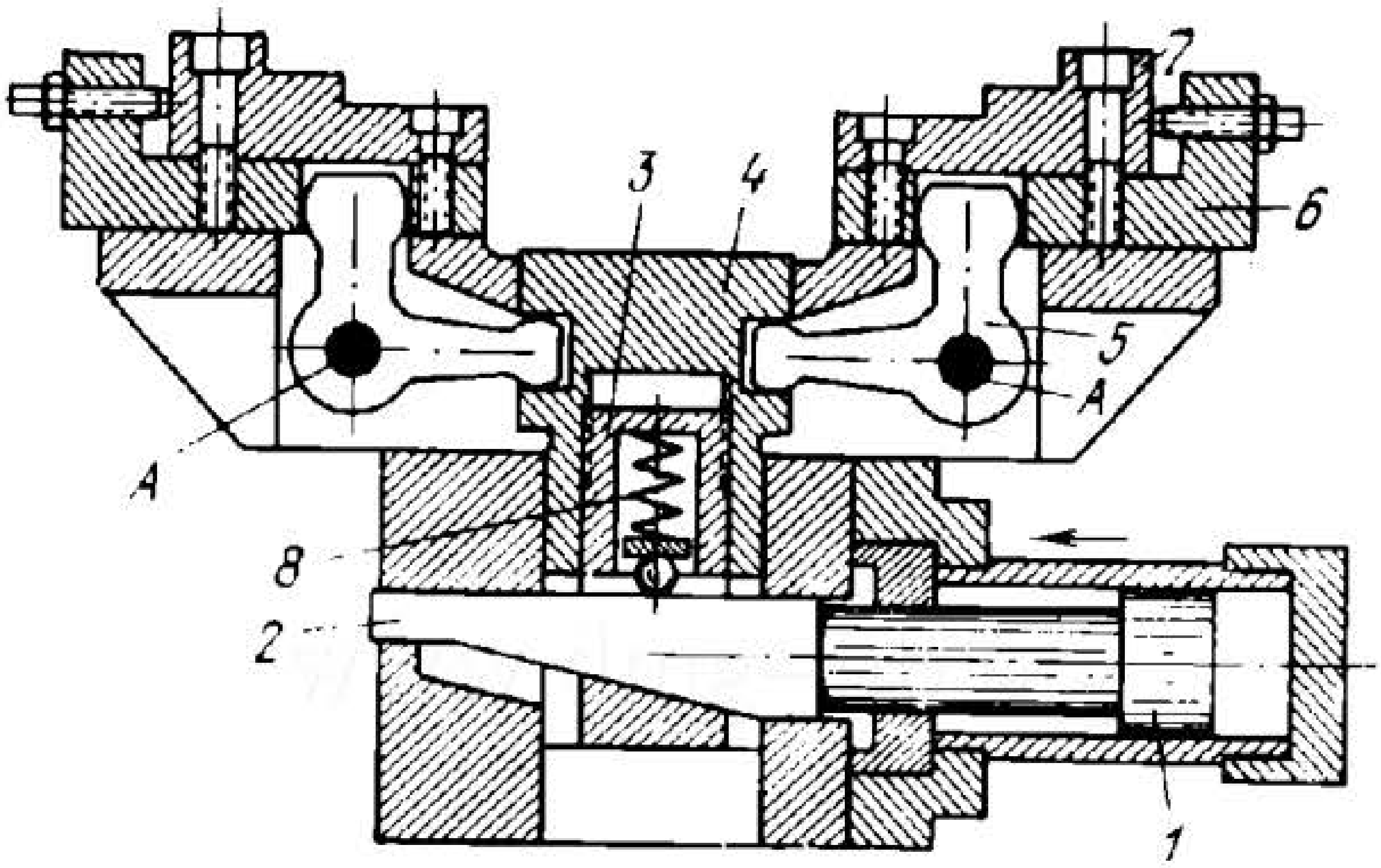
Workpiece *6* is located and clamped by master jaws *1* with interchangeable top jaws *2*. When piston *3* is moved downward by the action of fluid delivered to the top end of the cylinder, the piston rod pulls sleeve *4* downward, turning levers *5* about fixed axes *A* to move master jaws *1* toward the centre of the chuck. When piston *3* is moved upward by fluid delivered to the bottom end of the cylinder, jaws *1* are retracted, releasing workpiece *6*.

3890	LEVER MECHANISM OF A HYDRAULIC THREE-JAW SELF-CENTERING CHUCK	LHP GC



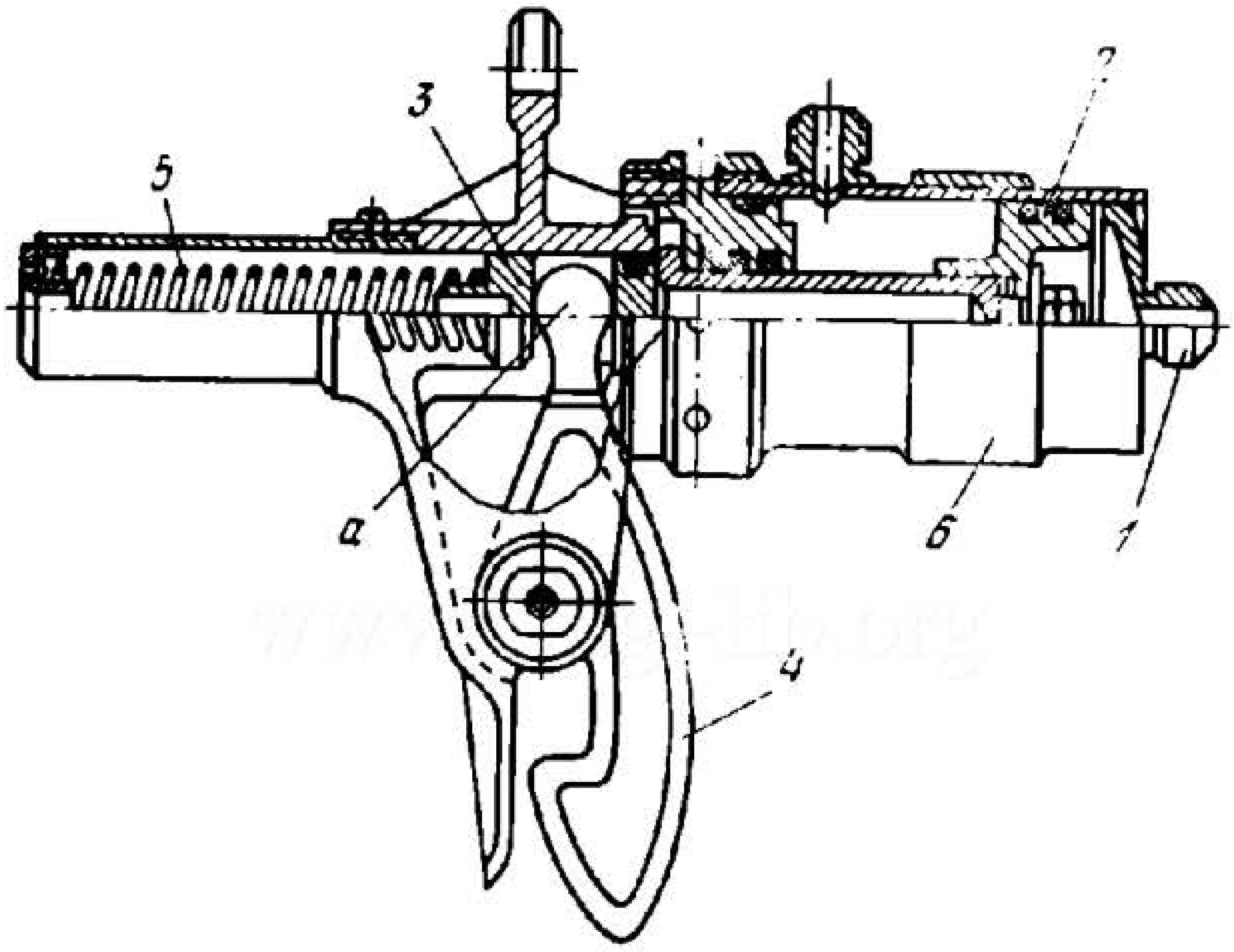
When piston *1* is moved to the right by the action of fluid delivered to the left end of the cylinder, sleeve *2*, mounted rigidly on the end of the piston rod, turns levers *3* about fixed axes *O*. Levers *3* move jaws *4* outward from the centre by an equal amount. Thus, the jaws locate and clamp a workpiece by its bore. The workpiece is released when piston *1* is moved to the left by spring *5*.

3891	WEDGE-LEVER MECHANISM OF A HYDRAULIC THREE-JAW SELF-CENTERING CHUCK	LHP GC



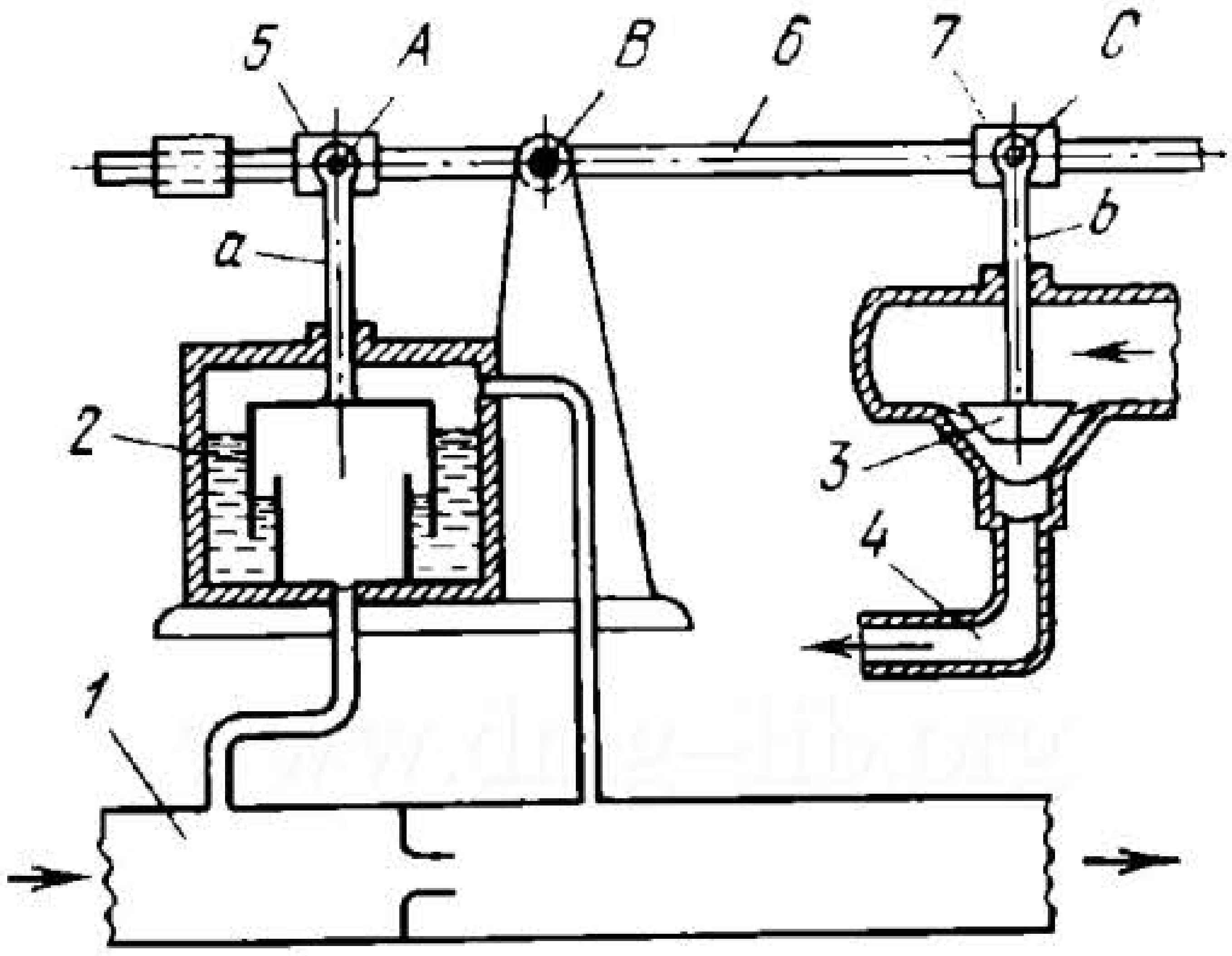
When piston *1* is moved to the left by the action of fluid delivered to the right end of the cylinder, wedge *2*, mounted rigidly on the end of the piston rod, pulls sleeves *3* and *4* downward. This turns levers *5* about fixed axes *A*, moving master jaws *6* with interchangeable top jaws *7* toward the centre by an equal amount. The jaws are retracted by spring *8* when piston *1* is moved to the right by fluid delivered to the left end of the cylinder. Two jaws are conventionally shown instead of three.

3892	LEVER MECHANISM OF A HYDRAULIC LANDING-GEAR LOCKING DEVICE	LHP GC



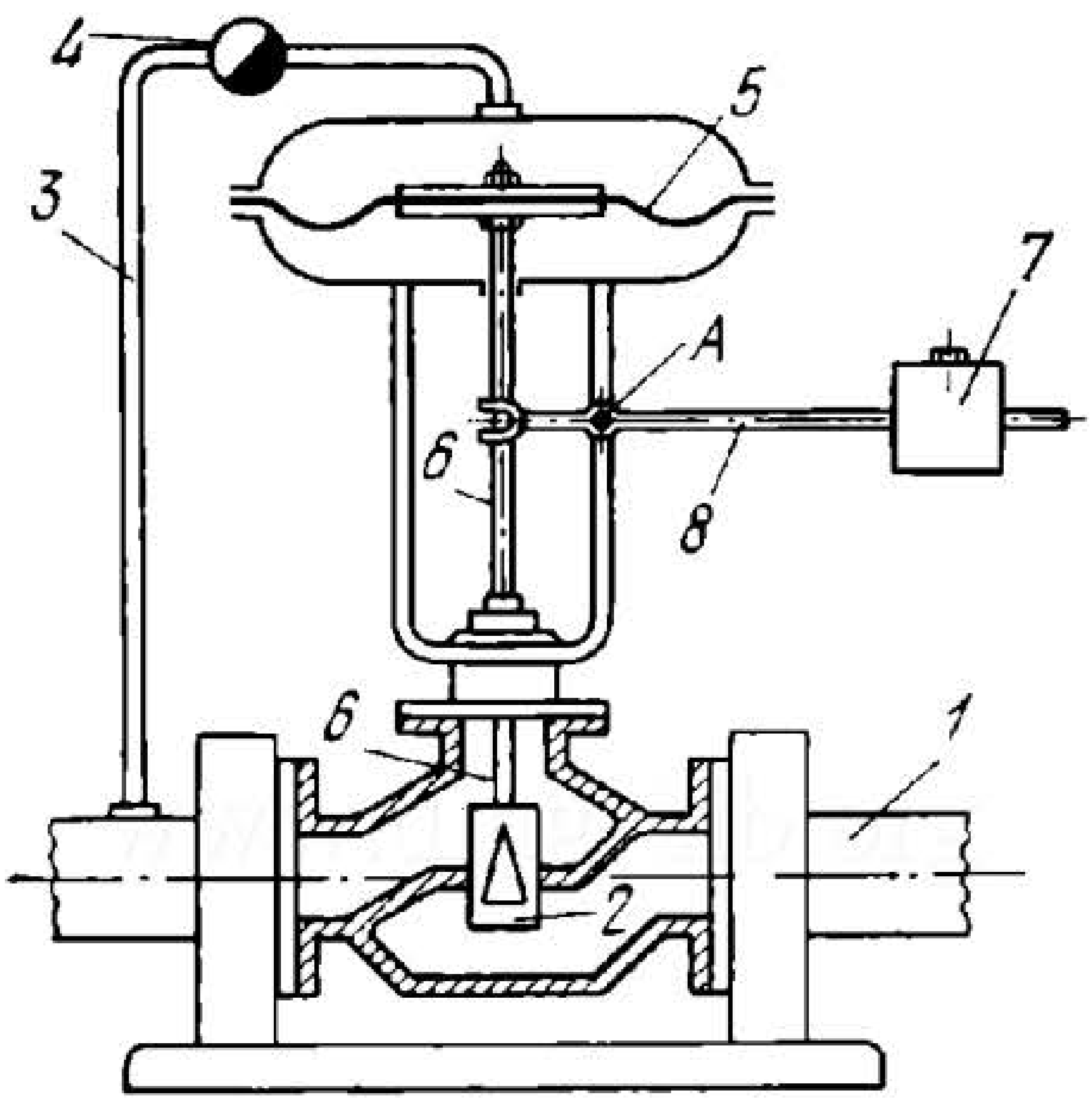
When the landing gear is lowered, fluid is delivered through connection *1* into cylinder *6*, moving piston *2* to the left. This shifts slide block *3* whose slot engages shank *a* of hook member *4*. As the hook member turns about its axis it releases the landing gear. Spring *5* returns the hook member and piston to the initial position.

3893	LEVER MECHANISM OF A FLUID DELIVERY REGULATOR	LHP Rg



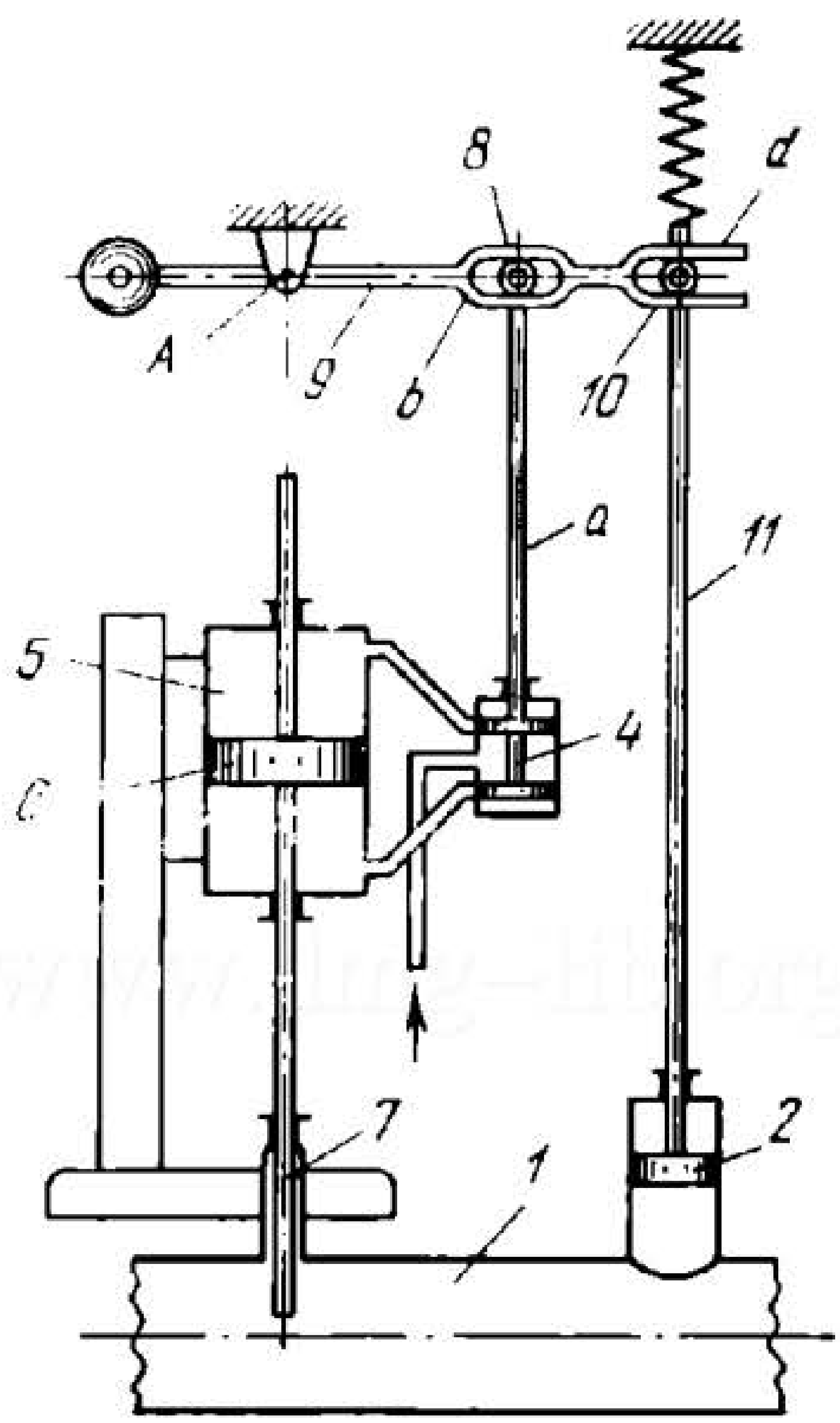
Rod *a* of cup *2* is connected by turning pair *A* to sleeve *5* which slides along the axis of lever *6*. Lever *6* turns about fixed axis *B*. Stem *b* of valve *3* is connected by turning pair *C* to sleeve *7* which also slides along the axis of lever *6*. When the pressure in the left portion of pipe *1* increases, cup *2* is raised, valve member *3* is lowered and the delivery of fluid into pipeline *4* is reduced. When the pressure in the left portion of pipe *1* drops, cup *2* is lowered, valve member *3* is raised and the delivery of fluid is increased.

3894	LEVER MECHANISM OF A PRESSURE REGULATOR	LHP Rg



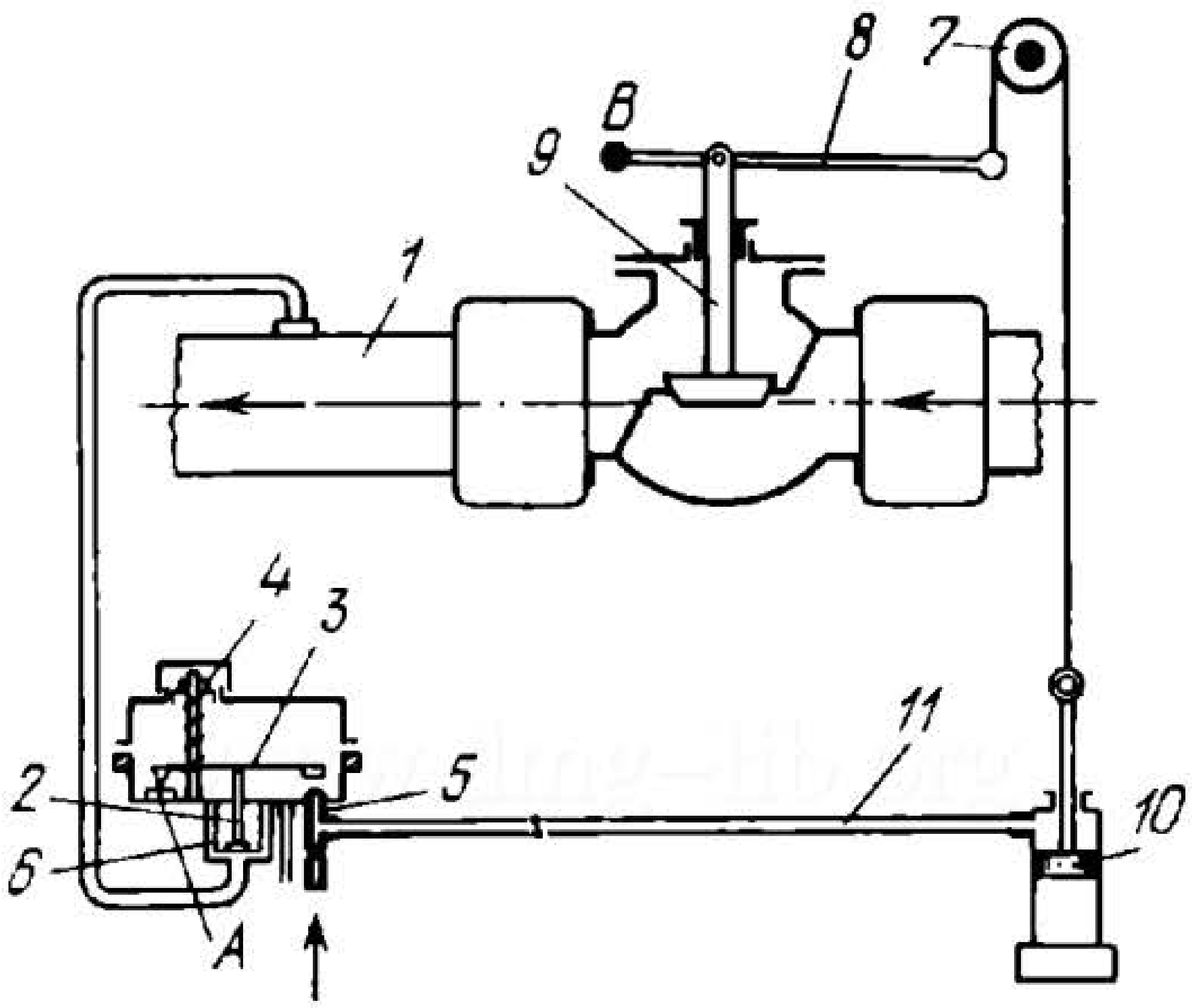
The fluid whose pressure is to be controlled flows along pipe *1*. A portion of the fluid flows along tube *3* and through flow-control valve *4* to the upper space of a membrane chamber. When the pressure of the fluid increases, membrane *5* is bent downward, shifting rod *6* and plunger *2*. This changes the amount of delivery and, consequently, the pressure. The pressure of the fluid acting on membrane *5* is counterbalanced by weight *7*, mounted on lever *8* which turns about fixed axis *A*. Weight *7* can be adjusted along lever *8*. When the pressure drops, the elements of the regulator operate in the reverse direction.

3895	LEVER MECHANISM OF A PRESSURE REGULATOR	LHP Rg



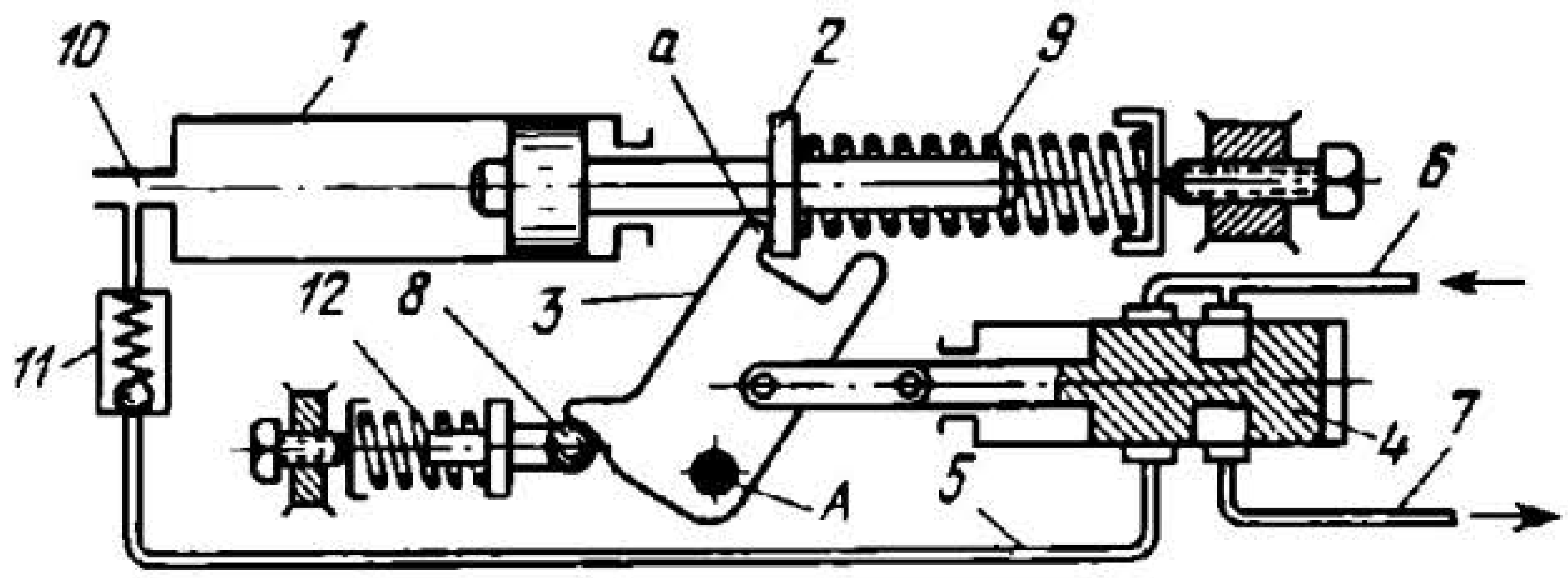
Mounted at the end of stem *a* of valve spool *4* is roller *8* which rolls and slides in slot *b* of lever *9*. Lever *9* turns about fixed axis *A* and has at one end fork *d* in which roller *10* of rod *11* slides and rolls. Rod *11* is attached to piston *2*. When the pressure in pipeline *1* increases, piston *2* moves upward and shifts valve spool *4* upward. This connects the upper end of cylinder *5* to the valve into which fluid is delivered. Piston *6* and shutter *7* begin to move downward, reducing the pressure in pipeline *1*. When the pressure drops, the elements of the regulator operate in the reverse direction.

3896	LEVER MECHANISM OF A PRESSURE REGULATOR	LHP Rg



When the pressure drops in pipeline *1*, the force transmitted by bellows *6* through pin *2* to lever *3* is reduced. As a result, lever *3* is turned by spring *4* about point *A* so that it closes nozzle *5*. At this, the pressure in pipeline *11* increases, and piston *10* moves downward, lifting the right end of lever *8* by means of flexible link *7*. Lever *8* turns about fixed axis *B* and raises valve member *9* to increase the supply of the heat-carrying agent to the system. When the pressure in pipeline *1* increases, the elements of the regulator operate in the reverse direction.

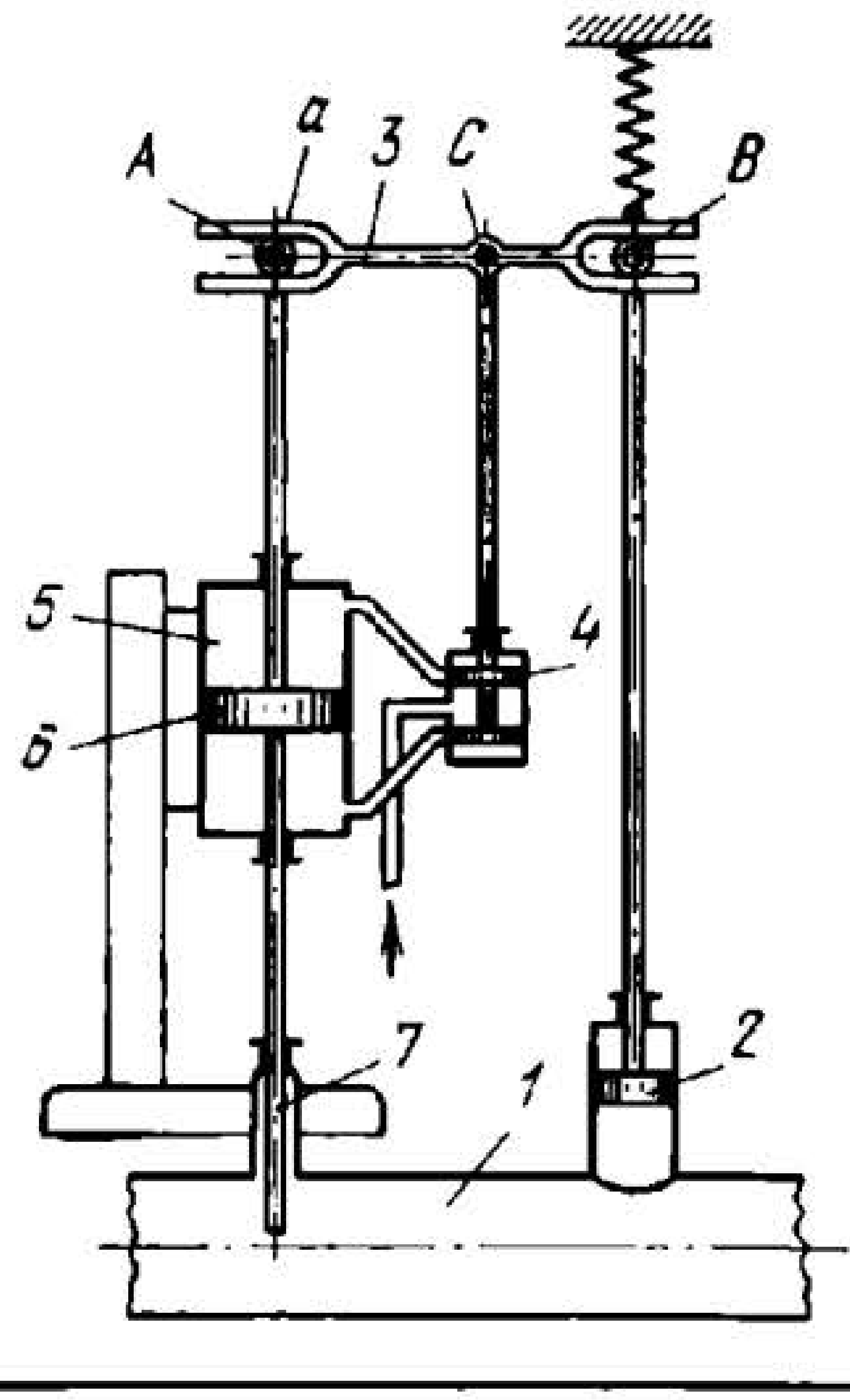
3897	LEVER MECHANISM OF A CAM-DRIVE PRESSURE REGULATOR	LHP Rg



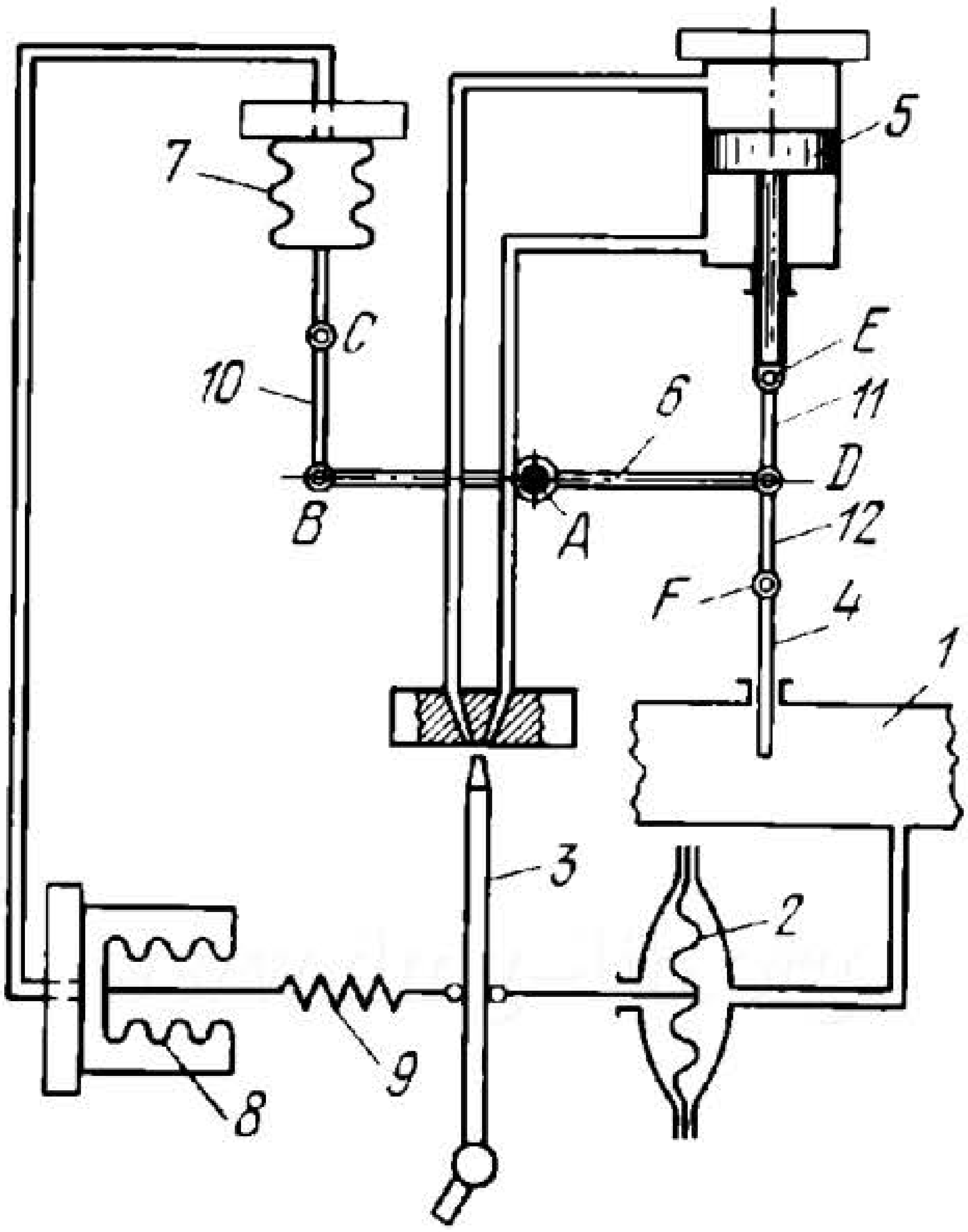
When the pressure drops in the system, connected by pipeline *10* to the left end of cylinder *1*, piston rod *2* is moved to the left by spring *9* and its flange engages lug *a* of cam *3*. This turns cam *3* about fixed axis *A*, shifting valve spool *4* to its left-hand position. At this, fluid is delivered by a pump through pipelines *6* and *5* and check valve *11* into the system. When the pressure in the system increases above a preset value, the piston and rod *2* are moved to the position shown and valve spool *4* connects the pump to the tank through pipelines *6* and *7*. Pusher *8* and spring *12* flip cam *3* rapidly from one extreme position to the other.

3898	LEVER MECHANISM OF A PRESSURE REGULATOR WITH DIRECT FEEDBACK	LHP Rg

When the pressure increases in pipeline *1*, piston *2* is moved upward and turns double-fork lever *3* about roller *A*, entering slot *a* of the lever. This shifts valve spool *4* upward so that the upper end of cylinder *5* is connected to the valve, into which fluid is delivered. At this, piston *6* and shutter *7* begin to move downward, turning lever *3* about roller *B*, mounted on the rod of piston *2*, so that point *C* begins to move downward together with valve spool *4*. After a certain time interval, point *C* reaches its initial position, valve spool *4* blocks off the ports to cylinder *5* and the motion of shutter *7* ceases. When the pressure in pipeline *1* drops, the elements of the regulator operate in the reverse direction.

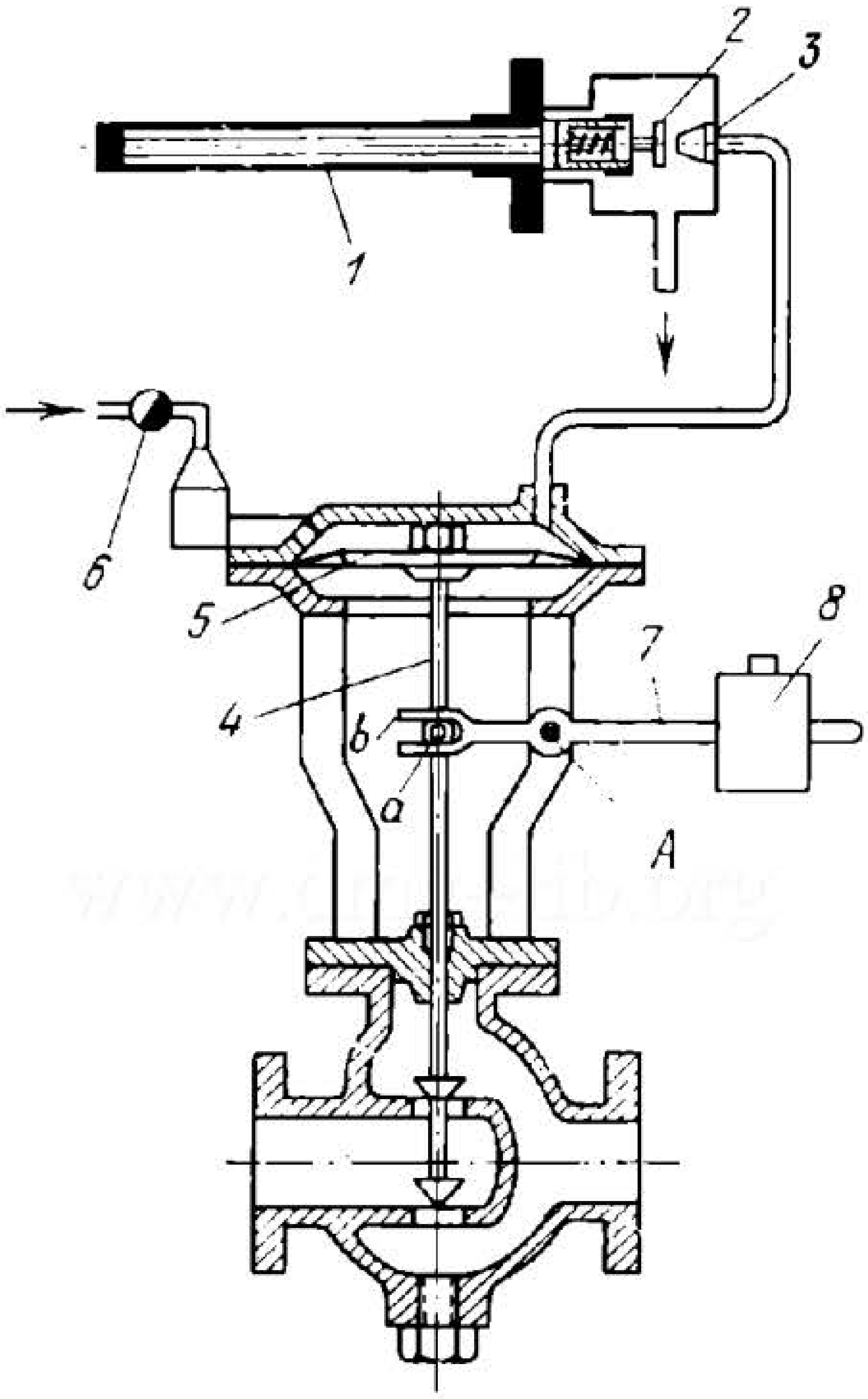


3899	LEVER MECHANISM OF A PRESSURE REGULATOR WITH DIRECT FEEDBACK	LHP Rg



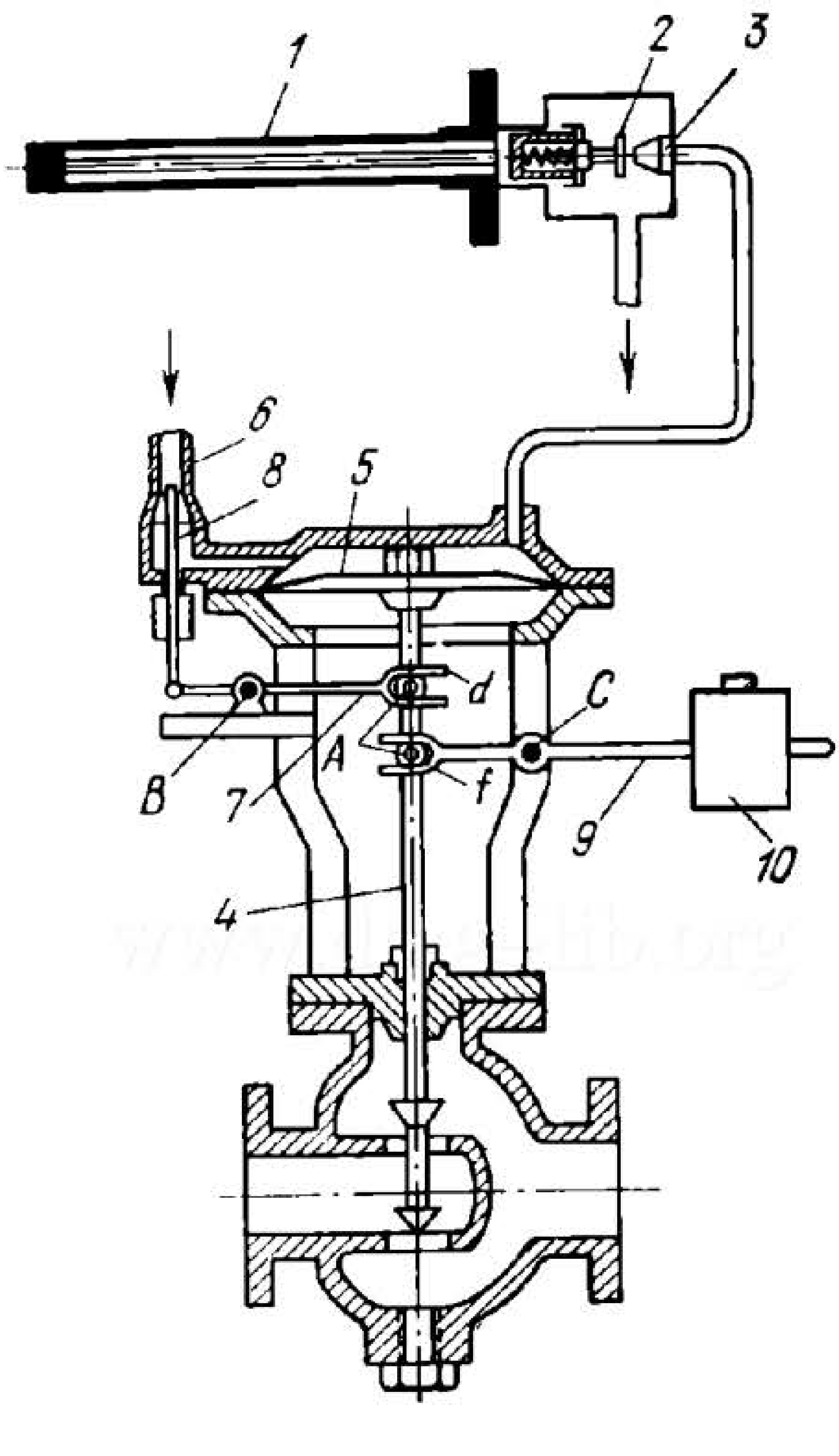
When the pressure increases in pipeline *1*, membrane *2* is bent to the left and it shifts jet valve nozzle *3* so that its jet is directed into the left channel and fluid is delivered to the top end of the servomotor. Piston *5* moves downward and shutter *4* is moved into pipeline *1*, reducing the pressure. At the same time, lever *6* is turned about fixed axis *A*, and intermediate link *10*, connected by turning pairs *B* and *C* to lever *6* and bellows *7*, compresses the bellows. The system consisting of two bellows, *7* and *8*, is filled with fluid and is fluid-tight. When bellows *7* is compressed the pressure in it increases. This compresses bellows *8* which, through spring *9*, shifts jet valve nozzle *3* back to its central position. When the pressure drops in pipeline *1*, the elements of the regulator operate in the reverse direction. Links *11* and *12* are connected by two turning pairs *D* to lever *6*, and by turning pairs *E* and *F* to piston *5* and to shutter *4*.

3900	LEVER MECHANISM OF A TEMPERATURE REGULATOR	LHP Rg



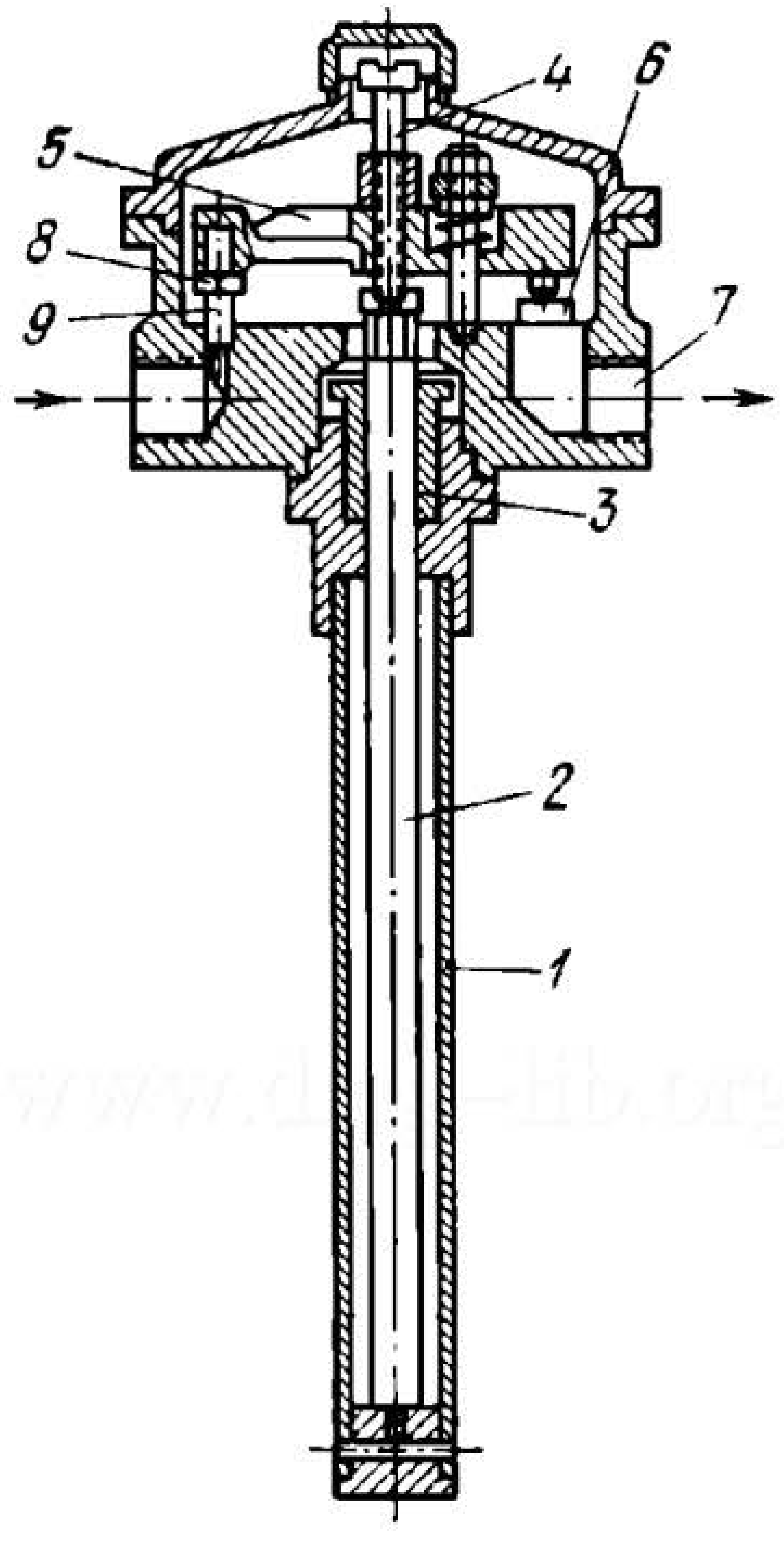
The working fluid is admitted into the system through flow-control valve *6* and is delivered to nozzle *3*. When the temperature of the item being controlled increases, thermoelement *1* moves shutter *2* toward nozzle *3*, thereby increasing the pressure acting on membrane *5*. This moves rod *4*, rigidly attached to the membrane, downward, reducing the supply of heat-carrying agent to the system and, consequently, the temperature of the item being controlled. When the temperature drops, the elements of the regulator operate in the reverse direction. Rod *4* has pin *a* which slides in fork *b* of lever *7*, turning about fixed axis *A*. Weight *8* can be adjusted along the axis of lever *7* to regulate the pressure on membrane *5*.

3901	LEVER MECHANISM OF A TEMPERATURE REGULATOR WITH DIRECT FEEDBACK	LHP Rg



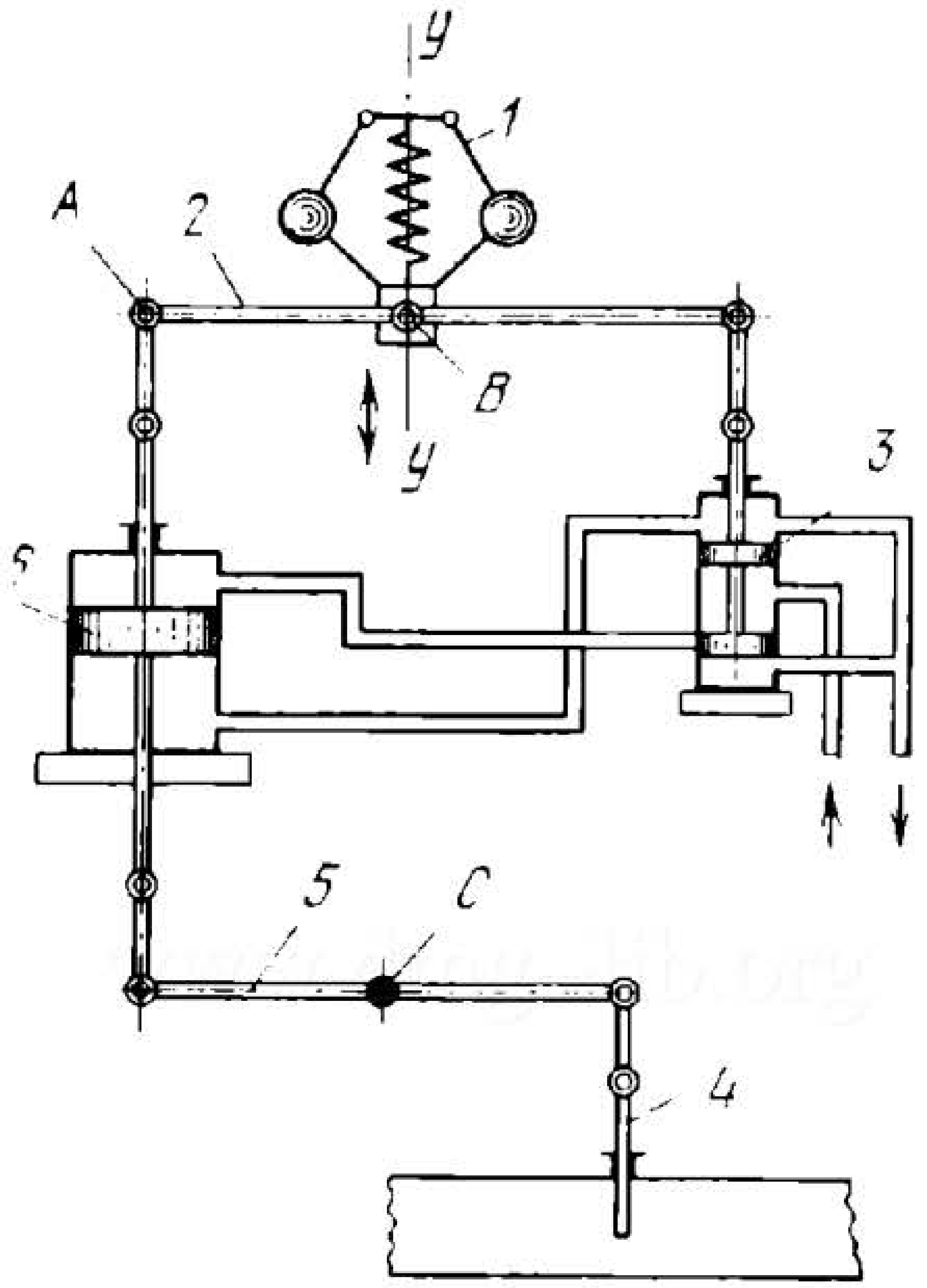
The working fluid is admitted into the system through flow-control valve *6* and is delivered to nozzle *3*. When the temperature of the item being controlled increases, thermoelement *1* moves shutter **2** toward nozzle *3*, thereby increasing the pressure acting on membrane *5*. This moves rod *4*, rigidly attached to the membrane, downward, reducing the supply of heat-carrying agent to the system and, consequently, the temperature of the item being controlled. As rod *4* moves downward, lever *7* raises needle *8*, partially closing the orifice in flow-control valve *6*. This reduces the delivery of working fluid to the system and the pressure on membrane *5*. When the temperature drops, the elements of the regulator operate in the reverse direction. Rod *4* has pins *A* sliding in forks *d* and *f* of levers *7* and *9*, which turn about fixed axes *B* and *C*. Weight *10* can be adjusted along the axis of lever *9* to regulate the pressure on membrane *5*.

3902	LEVER MECHANISM OF A THERMOELEMENT	LHP Rg



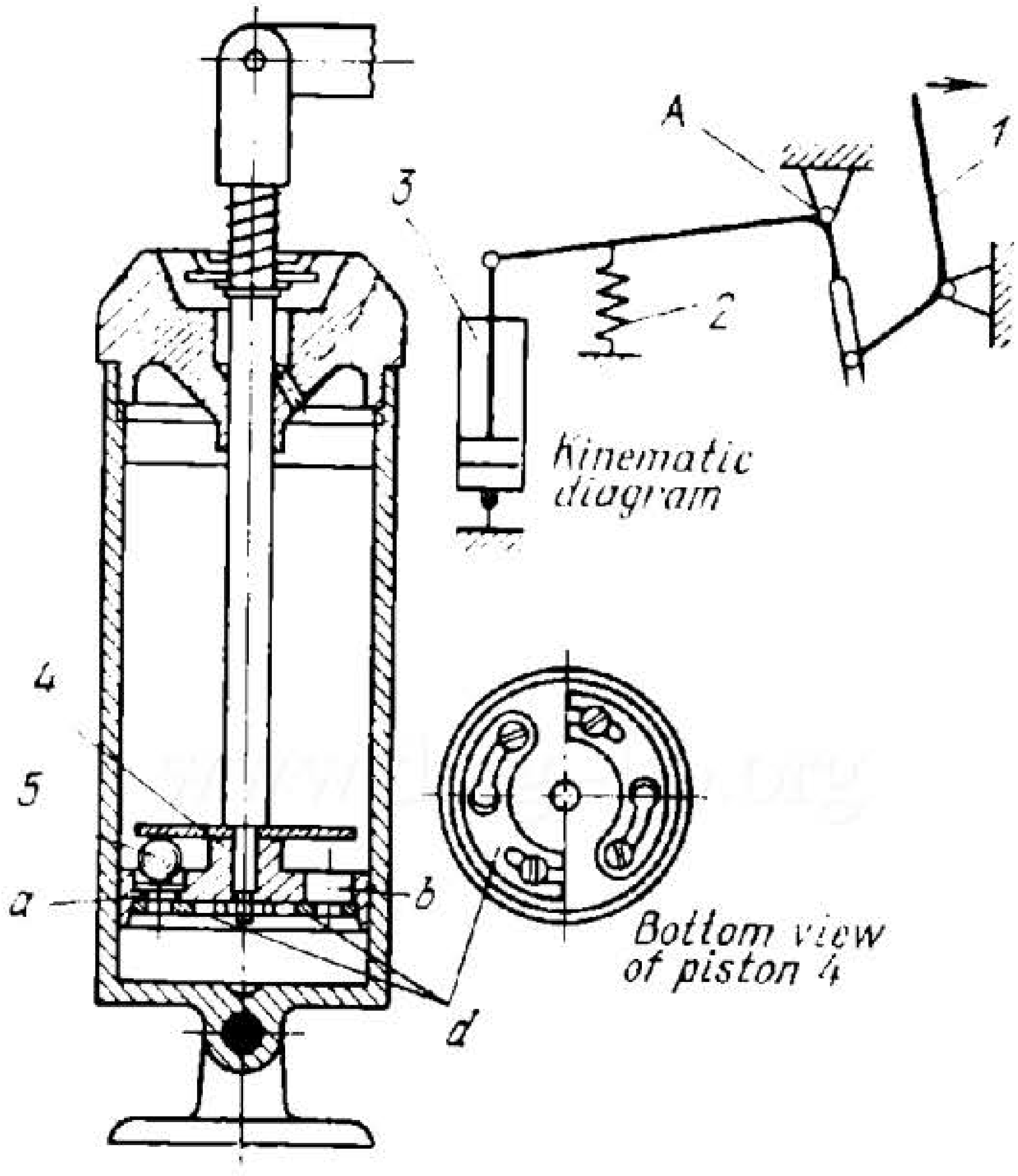
Tube *1* is made of a material with a larger coefficient of linear expansion than that of rod *2* inside the tube. The outer end of rod *2* is rigidly attached to tube *1* and the inner end slides in guide bushing *3*. This end of rod *2* contacts the tip of screw *4* which is screwed into lever *5*. Lever *5* has two supports *6* on which it turns. On its other end, lever *5* has shutter *8*, opposite which is cylindrical nozzle *9*. Fluid delivered to nozzle *9* flows in through the clearance between the shutter and nozzle and out through port *7*. The thermoelement is immersed into the medium whose temperature is to be controlled. When the temperature increases, tube *1* expands more than rod *2* which is pulled into the tube. At this, lever *5* turns counterclockwise and shutter *8* approaches nozzle *9*, reducing the clearance through which the fluid flows. This raises the pressure in the cylinder of a servomotor (not shown) which makes the necessary changes in the item being controlled. When the temperature drops, the elements of the regulator operate in the reverse direction.

3903	LEVER MECHANISM OF A SPEED REGULATOR WITH DIRECT FEEDBACK	LHP Rg



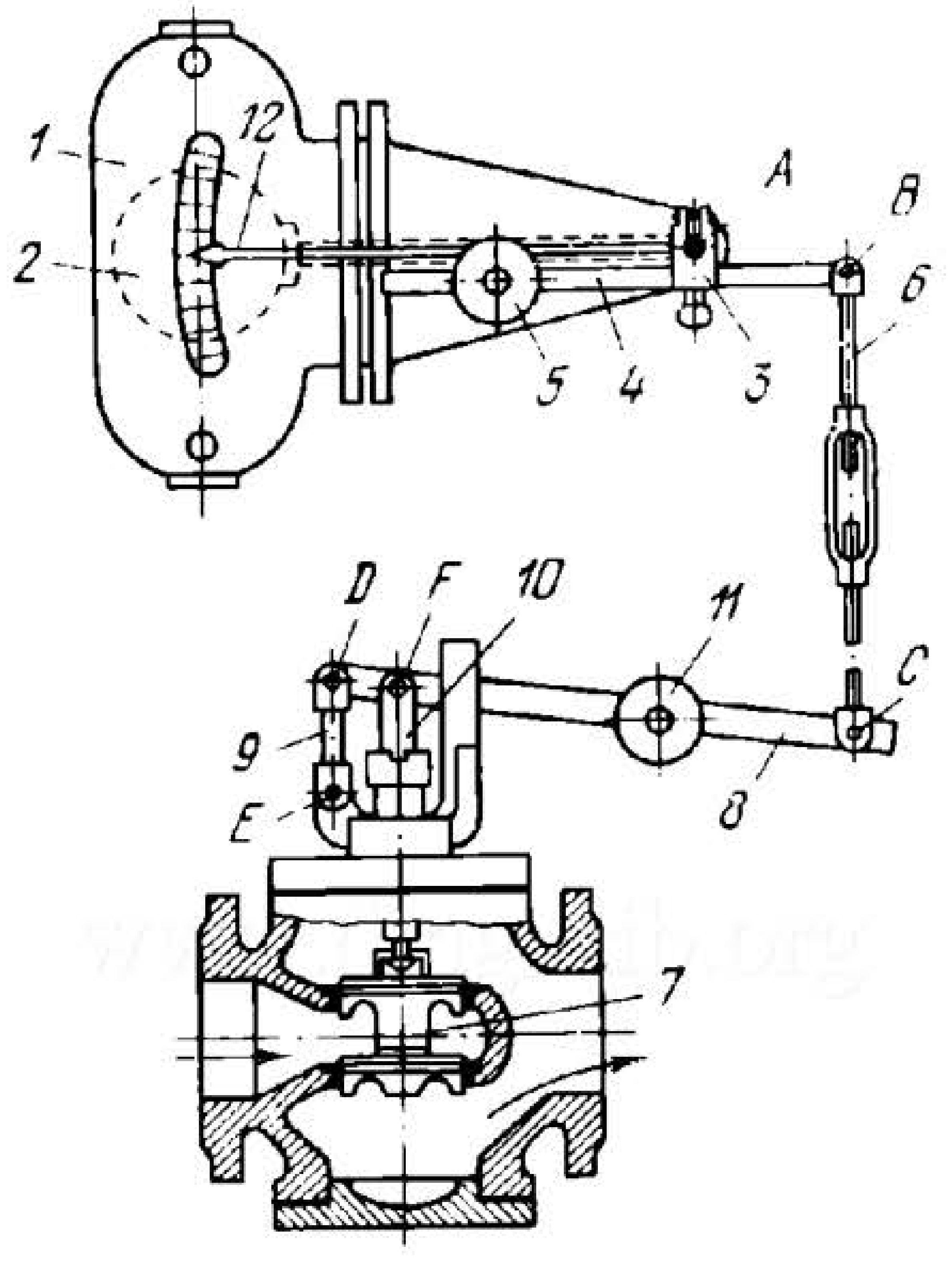
When the speed of the machine increases, the balls of centrifugal governor *1* move outward and its sleeve is raised along axis *y-y*, turning lever *2* about point *A*. This raises valve spool *3*, admitting fluid to the lower end of the servomotor. As a result, piston *6* of the servomotor moves upward, turning lever *5* about fixed axis *C* to lower shutter *4* and reduce the supply of the heat-carrying agent to the machine. As piston *6* moves upward, it turns lever *2* about point *B* and shifts valve spool *3* downward. When the spool reaches its middle position, piston *6* of the servomotor stops. When the speed drops, the elements of the regulator operate in the reverse direction.

3904	LEVER MECHANISM OF THE TORQUE REGULATOR FOR A CALCULATOR	LHP Rg



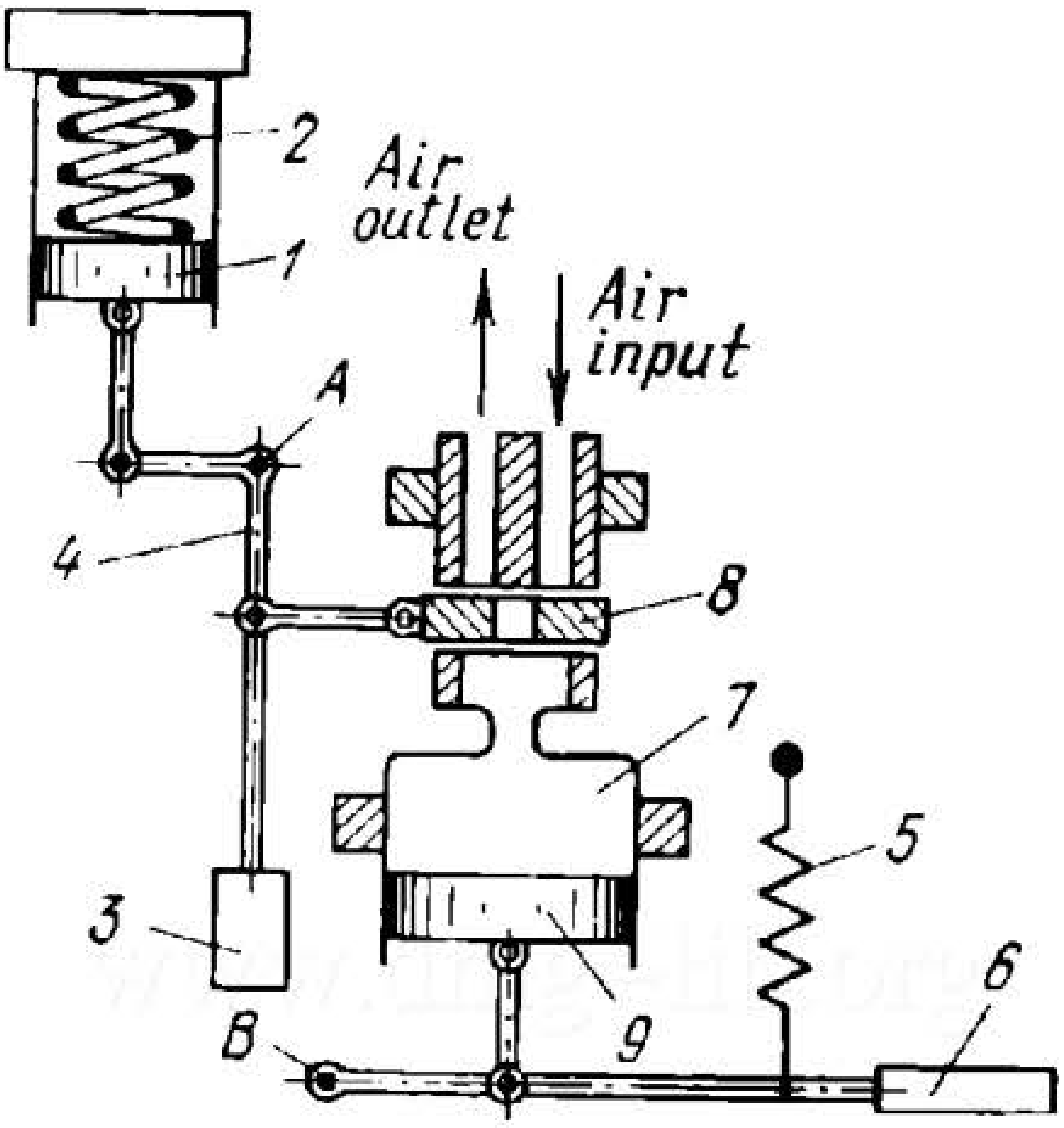
The purpose of the regulator is to transmit a constant torque to shaft *A* of the calculator mechanism when a clockwise force is applied to bell-crank lever *1* (see kinematic diagram). The torque on shaft *A* is equalized by regulating the clear opening of orifice *b* by means of shaped washers *d*. At this time, orifice *a* is closed by ball valve *5*. As the mechanism is returned to its initial position by spring *2*, piston *4* moves downward and fluid raises ball *5* and passes through both orifices *a* and *b*, sharply reducing the braking effect.

3905	LEVER MECHANISM OF A LIQUID LEVEL REGULATOR	LHP Rg



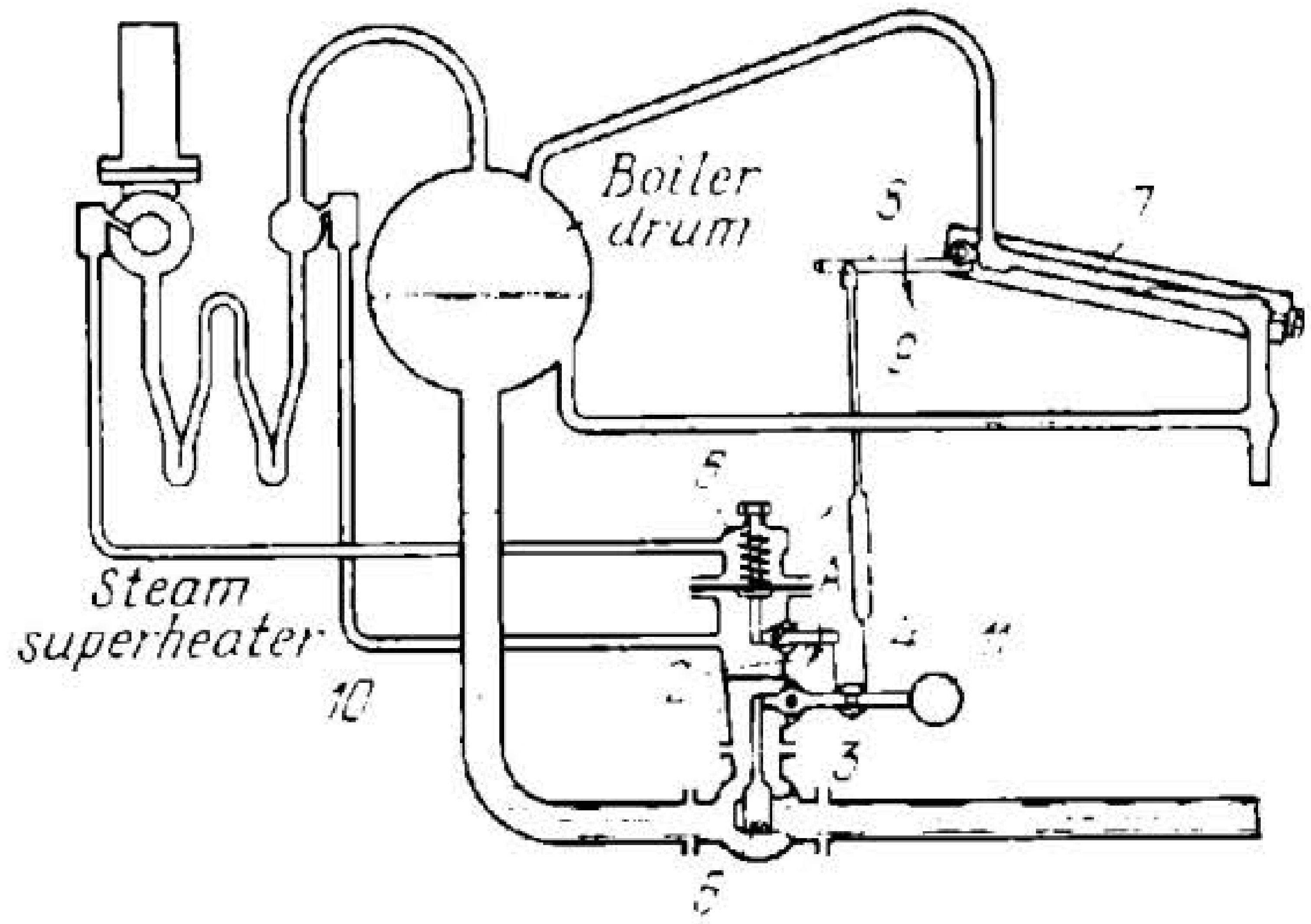
Float chamber *1* is connected to the tank whose level is to be controlled. Inside chamber *1* is float *2* (shown by a dash line) which is attached to a lever turning about fixed axis *A*. Also turning about axis *A* is yoke *3* through which lever *4* passes. Lever *4* is connected by turning pair *B* to tie-rod *6*. Secured on the other end of lever *4* is weight *5*. Tie-rod *6* is connected by turning pair *C* to lever *8* which, in turn, is connected by turning pair *D* to link *9* and by turning pair *F* to intermediate link *10*. Link *9* turns about fixed axis *E*. Intermediate link *10* links valve *7* to lever *8* along whose axis weight *11* can be adjusted. Hand *12*, indicating the level of the liquid on a scale, is attached to the shaft at axis *A*. If the level in the tank drops, float *2* moves downward and lever *4* turns counterclockwise about axis *A*. This opens valve *7* and increases the supply of liquid to the tank. The liquid flows through valve *7* in the direction of the arrows.

3906	LEVER MECHANISM OF A TORPEDO DEPTH REGULATOR	LHP Rg



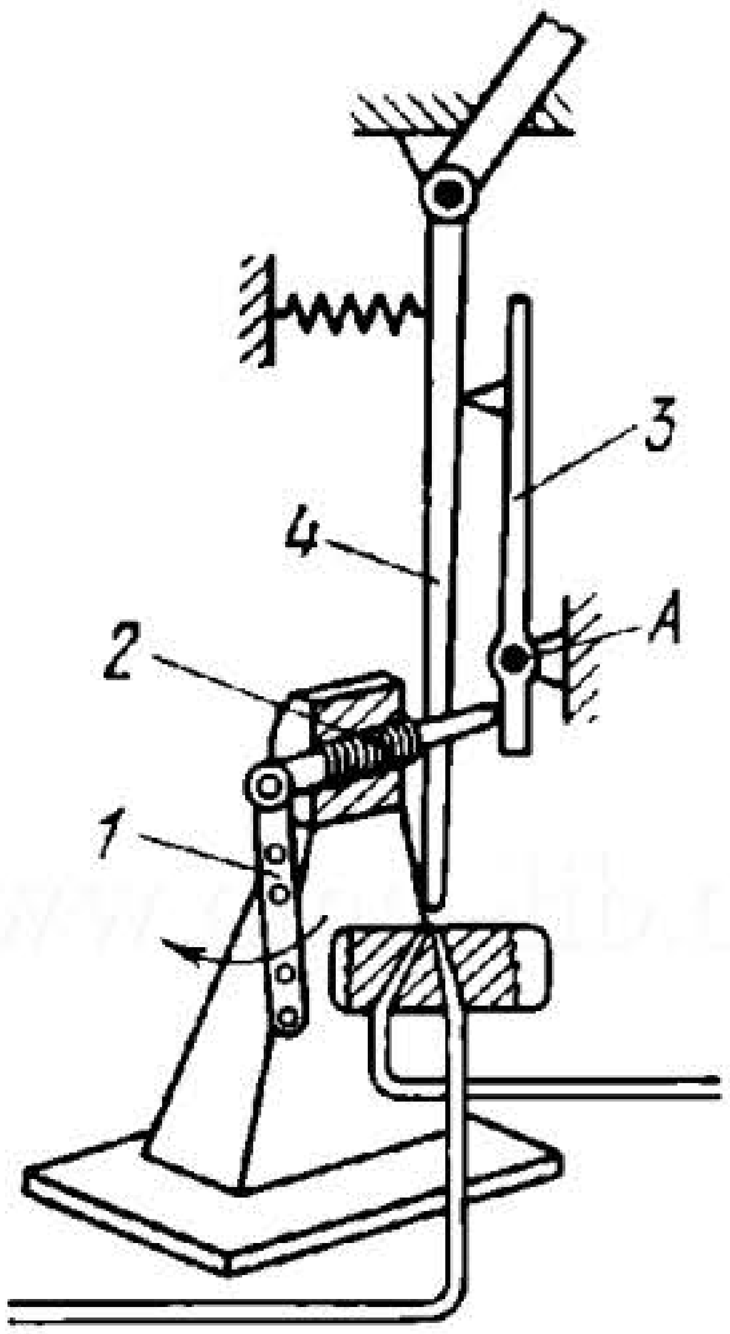
Acting on piston *1* from underneath is the hydrostatic pressure of the water and from above, the pressure of compressed air and spring *2*. Piston *1* remains in its middle position as long as the torpedo maintains the preset depth. Linked to piston *1* through bell-crank lever *4*, turning about fixed axis *A*, is pendulum *3* which is sensitive to the inclination (tilt) of the torpedo. When the torpedo tilts, pendulum *3* turns with respect to the body and is used, together with piston *1*, to operate the depth rudder. When the depth at which the torpedo travels decreases, and its nose is raised, piston *1* and pendulum *3* shift shutter *8* to the right. This admits compressed air into cylinder 7 of the servomotor and moves piston *9* downward to lower depth rudder *6* which turns about fixed axis *B*. When the depth increases, cylinder 7 of the servomotor is connected to the outlet pipe and spring *5* raises depth rudder *6*.

3907	LEVER MECHANISM OF A TWO-IMPULSE FEED REGULATOR	LHP Rg



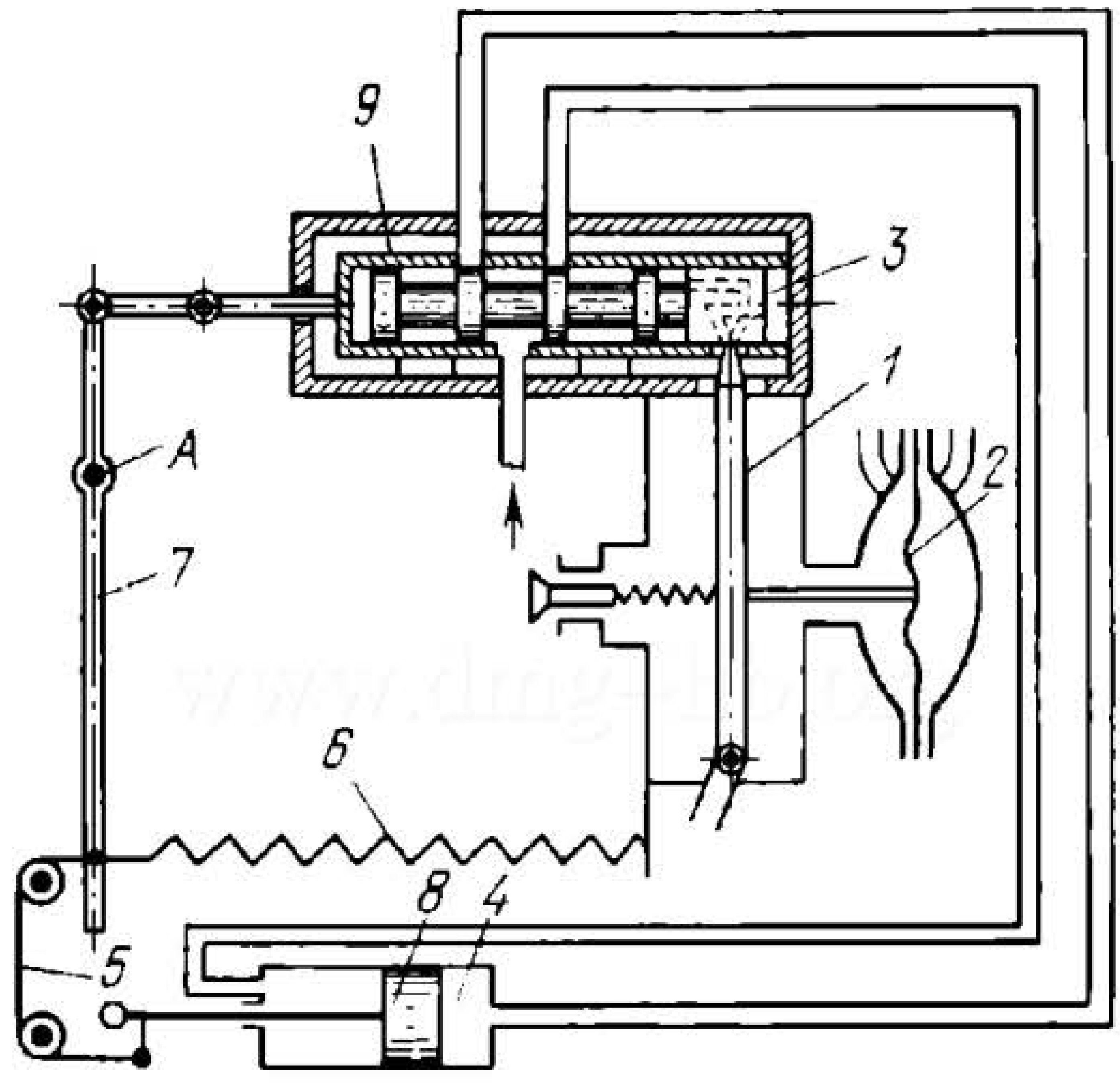
Acting on membrane *1* of the regulating valve is the difference in the pressures in the steam superheater and in pipeline *10* connected to the boiler drum. Membrane *1* is linked to lever *2* which turns about fixed axis *A*. Attached to the end of lever *2* is a chain which runs over pulley *3*, turning about an axle mounted on lever *4*. Lever *4* has weight *11* at one end and the other end is linked to valve *5*. When the steam consumption is increased, membrane *1* is bent upward, compressing spring *6*. This turns lever *2* clockwise, lever *4* is moved downward by weight *11* and plunger *5* moves upward, increasing the water supply to the boiler. The second impulse actuating the regulator is obtained by the change in the water level in the boiler drum which is connected to thermostatic tube *7* with an elongating rod. The right end of the rod is fixed and the other end is linked to bell-crank lever *8* to which tie-rod *9* is hinged. Tie-rod *9* is linked to the chain whose other end is secured to lever *2* of the valve. The lower end of tube *7* is connected to the boiler drum under the water level; the upper end, to the drum above the water level, occupied by steam. When the water level in the boiler drum drops, the rod of thermostatic tube *7* is elongated, lever *8* is turned counterclockwise so that tie-rod *9* moves downward. This lowers lever *4* and raises plunger *5*, increasing the water supply to the drum. If steam consumption is reduced, the elements of the regulator operate in the reverse direction.

3908	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg



When lever *1*, linked to the piston of a servomotor, turns clockwise, spindle *2*, connected by a screw pair to the upright, turns lever *3* about fixed axis *A*. Lever *3* shifts jet valve nozzle *4*. Spindle *2* is conventionally shown: its axis is in the plane of the drawing.

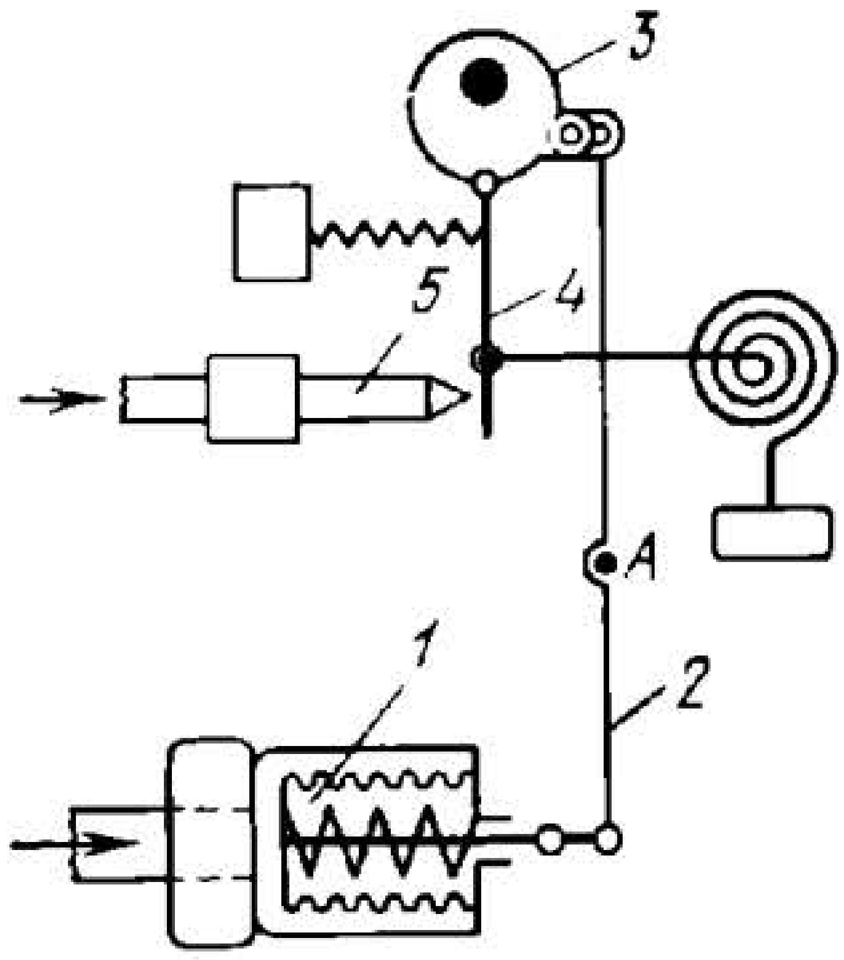
3909	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg



When jet valve nozzle *1* is shifted by a change in pressure acting on membrane *2*, valve spool *3* is shifted to connect a groove of the spool with cylinder *4* of the servomotor whose piston *8* is moved by the working fluid. Lever *7*, turning about fixed axis *A*, is linked to piston *8* by flexible link *5* and is subject to the action of stretched spring *6*. Lever *7* shifts sleeve *9*, disconnecting the groove of valve spool *3* from servomotor cylinder *4*.

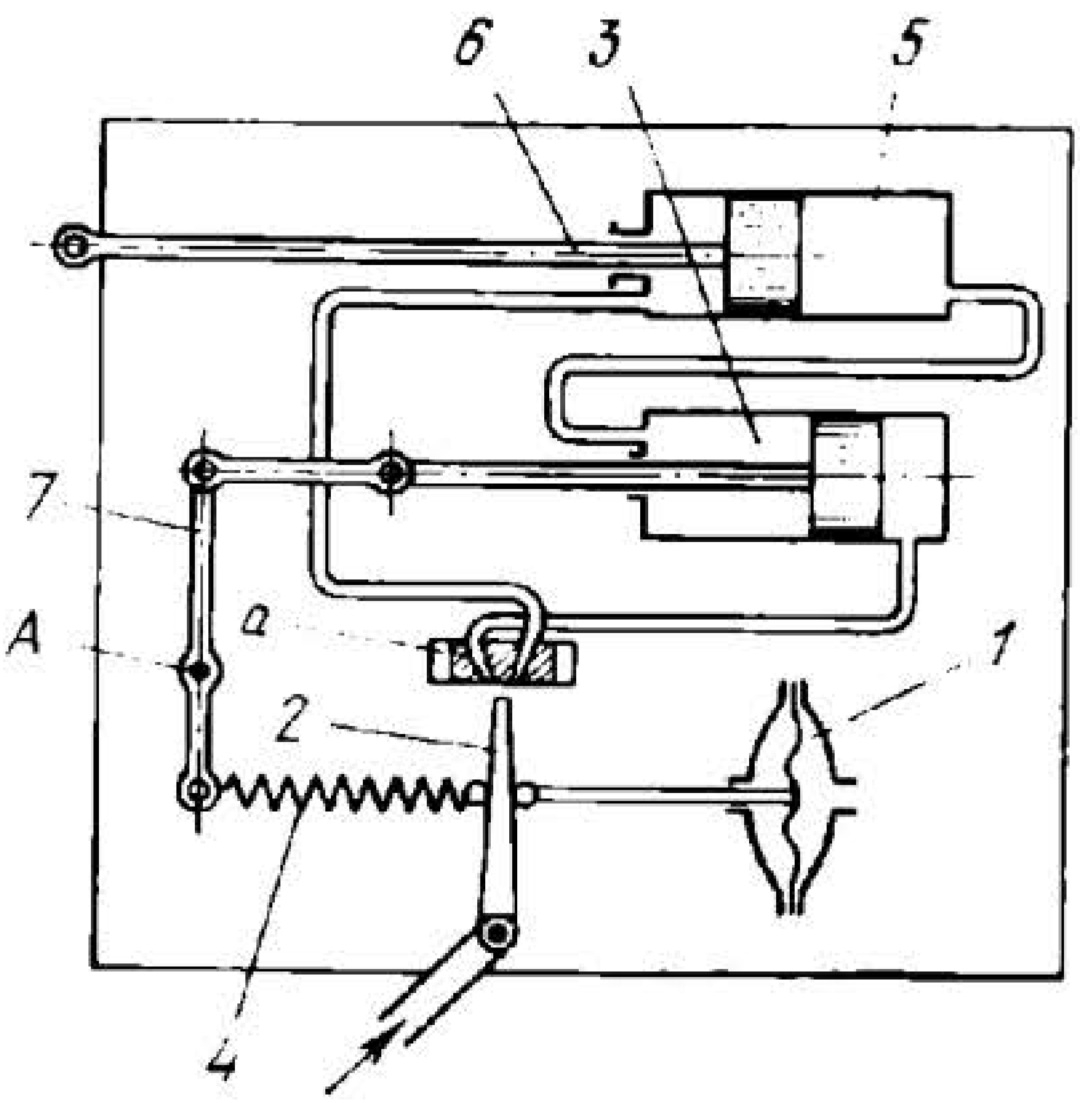
3910	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg

When the pressure of the air acting on feedback bellows *1* is increased, the bellows is compressed, turning lever *2* about fixed axis *A*. Lever *2* turns link *3* from which shutter *4* is suspended. As a result, shutter *4* approaches nozzle *5*. When the air pressure drops, the elements of the direct feedback mechanism operate in the reverse direction.

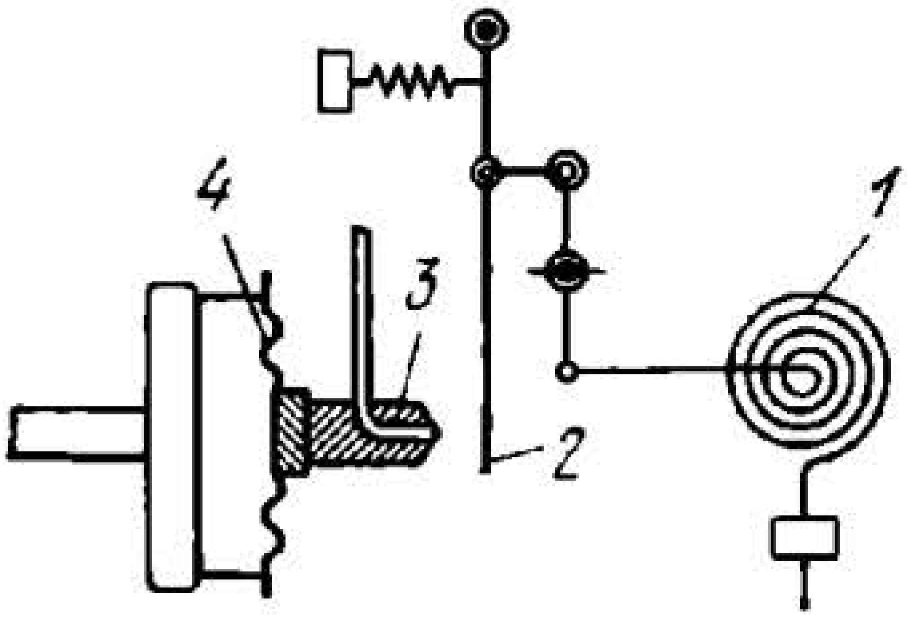


3911	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg

When the pressure on membrane *1* is increased, the membrane is bent to the left, shifting jet valve nozzle *2* so that it is opposite left-hand channel *a* which is connected to the right end of cylinder *3*. From the left end of cylinder *3*, fluid is delivered to the right end of operating cylinder *5*. As piston rod *6* moves to the left, it makes the necessary changes in the item being controlled (not shown). At the same time, lever *7* is turned about fixed axis *A* and, through spring *4*, shifts jet valve nozzle *2* back to the central position. When the pressure on membrane *1* is reduced, piston rod *6* moves in the reverse direction.

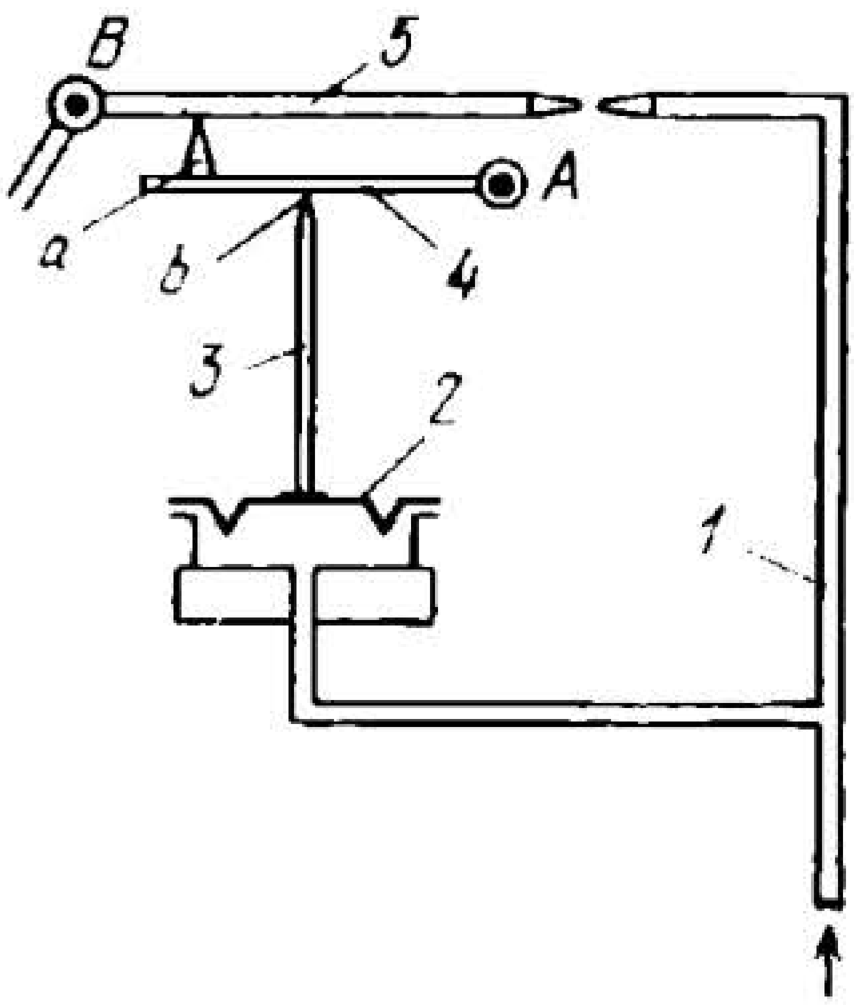


3912	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg



When the pressure increases in Bourdon tube *1*, shutter *2* approaches nozzle *3* and the pressure before the nozzle is raised. This pressure acts on a valve which releases air from a servomotor, thereby reducing the pressure acting on membrane *4*. At this, nozzle *3* is withdrawn from shutter *2*. When the pressure drops in the item being controlled, the elements of the regulator operate in the reverse direction.

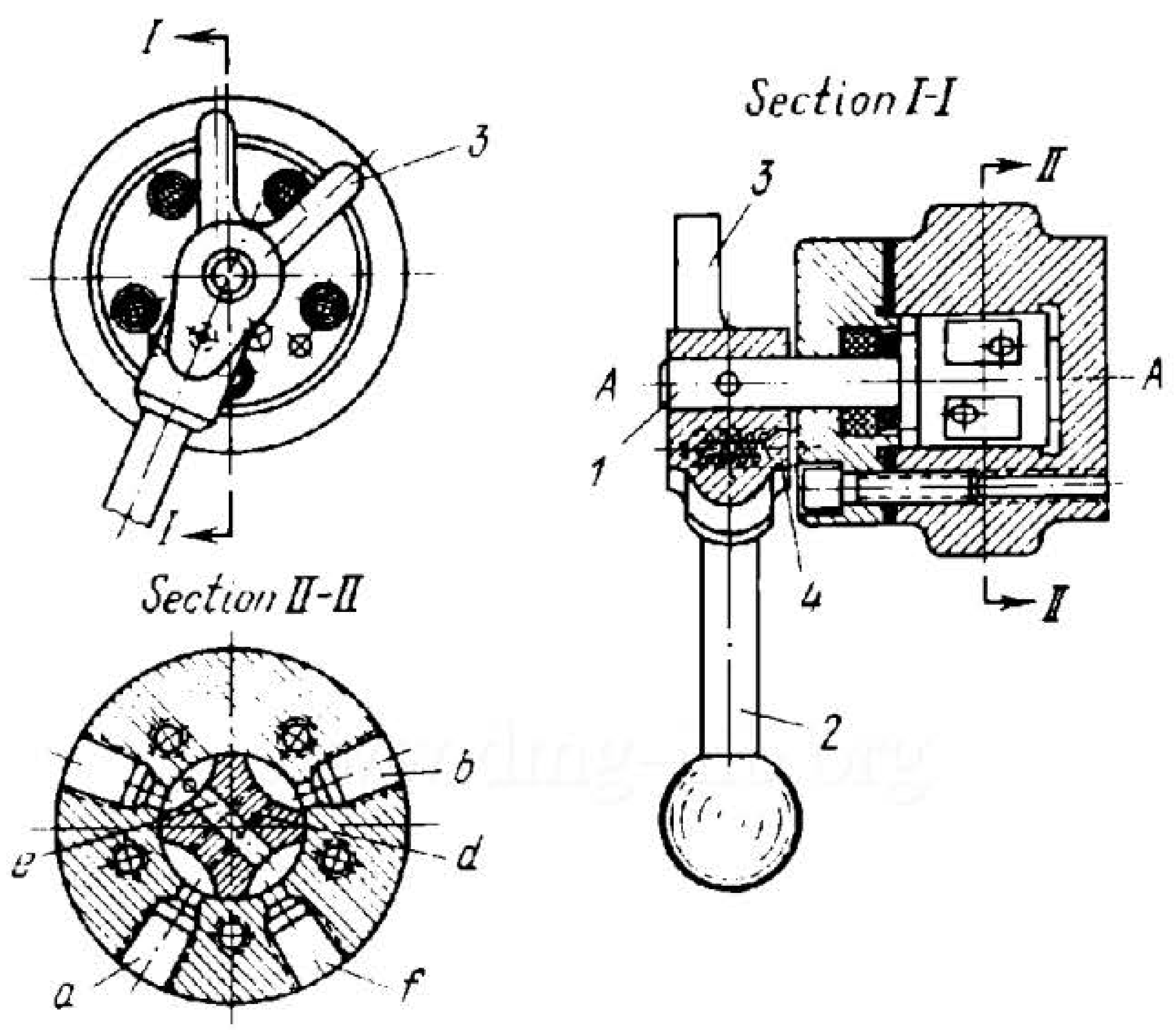
3913	LEVER MECHANISM OF DIRECT FEEDBACK IN A REGULATOR	LHP Rg



When the pressure increases in pipeline *1*, membrane *2* is bent upward, shifting rod *3*, lever *4* and jet valve nozzle *5* upward. Lever *4* turns about fixed axis *A* and jet valve nozzle *5* turns about fixed axis *B*. Rod *3* and lever *4* have points *b* and *a* which slide along lever *4* and jet valve nozzle *5*. When the pressure drops in pipeline *1*, the elements of the regulator operate in the reverse direction.

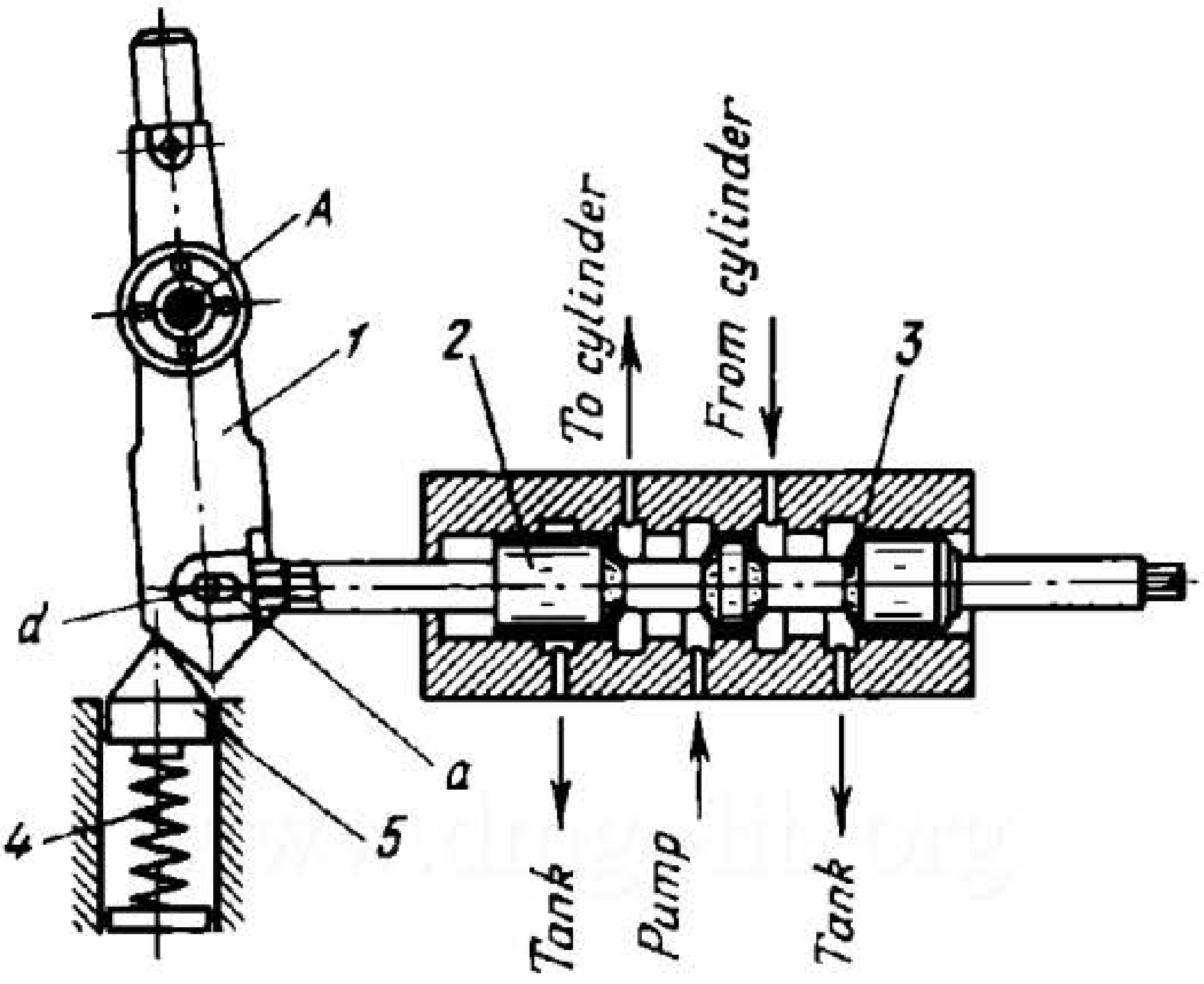
4. FLOW-CONTROL AND DIRECTIONAL VALVE MECHANISMS (3914 through 3925)

3914	LEVER MECHANISM OF A ROTARY DIRECTIONAL VALVE	LHP FC



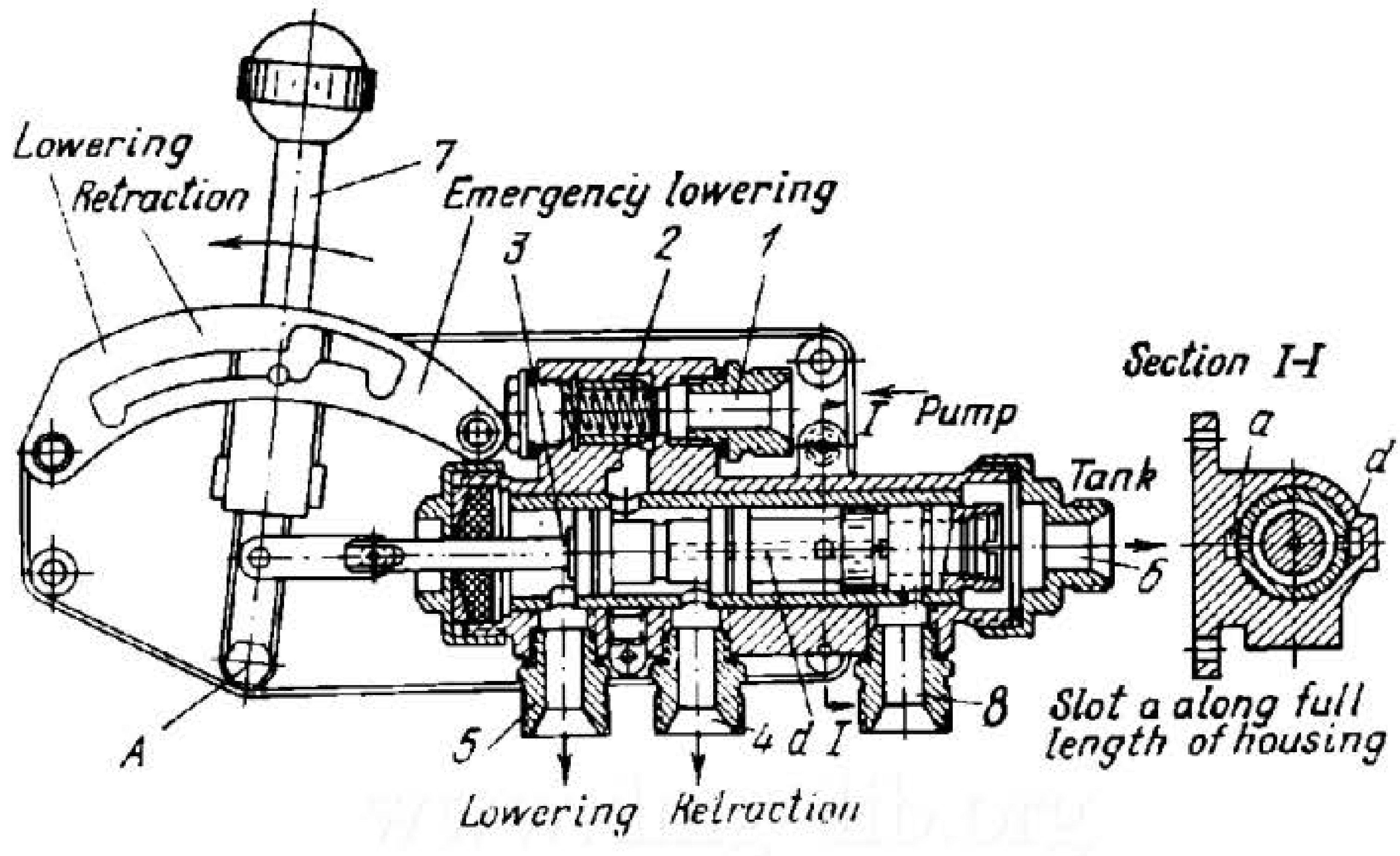
Direction of fluid flow is controlled by rotary member *1*. In the position shown, fluid from the pump passes from port *a* through passage *d* and port *b* to the system. Port *f* is connected through passage *e* to the tank. When the valve is switched over by turning valve member *1* through 45° about fixed axis *A*-*A*, either by means of handle *2* or by trip dogs of the machine tool actuating lugs *3*, port *b* is connected through passage *e* to the tank. Ball-click stop *4* holds the rotary member in the required positions.

3915	LEVER MECHANISM OF A SPOOL-TYPE DIRECTIONAL VALVE	LHP FC



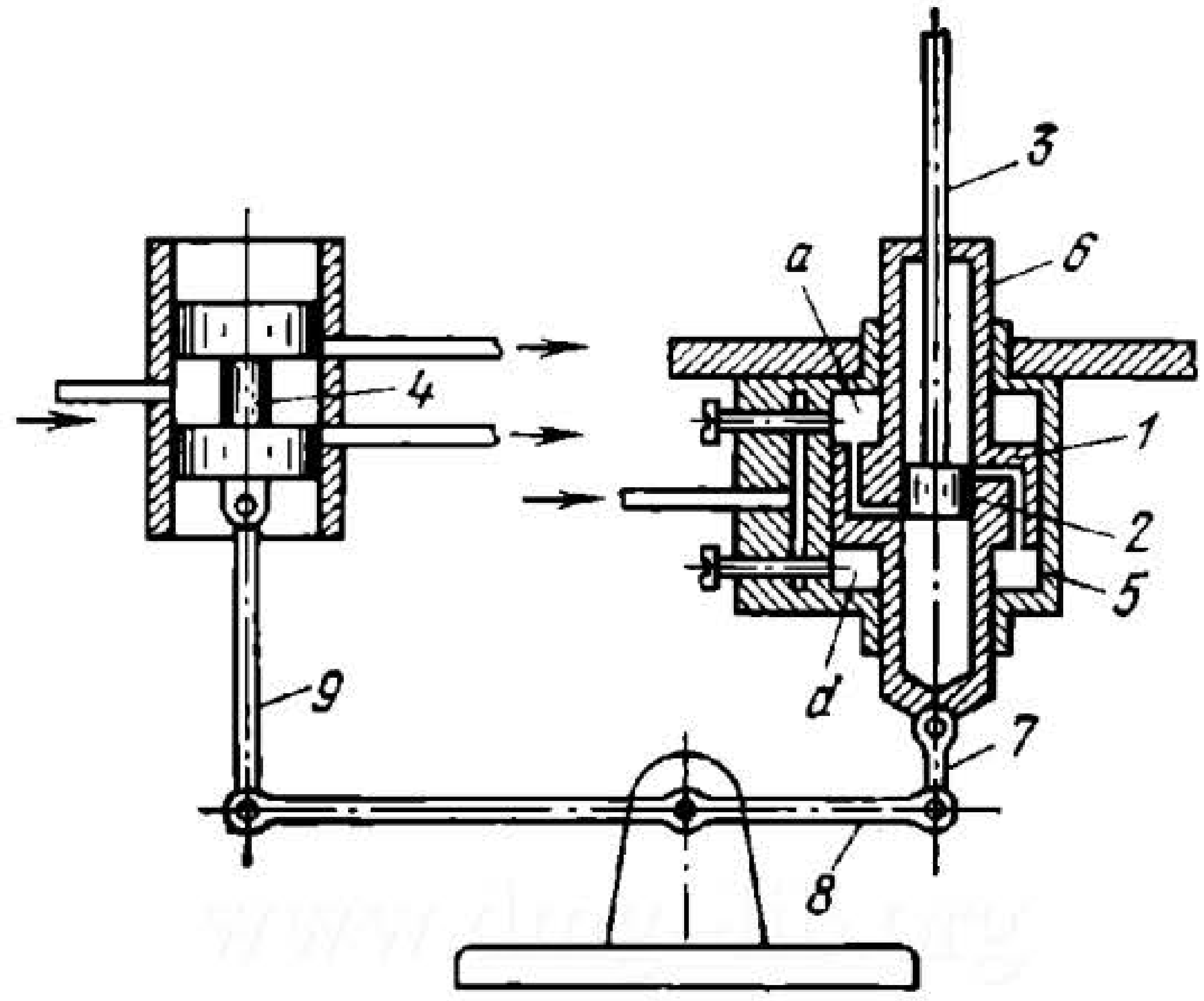
In the position of spool *2* shown, fluid under pressure is delivered from the pump to the power cylinder. Fluid from the exhaust end of the cylinder is drained through a groove of spool *2* to the tank. Braking of the machine tool table, linked to the piston of the power cylinder, is accomplished by cones *3* of spool *2*, which throttle the fluid being drained to the tank. When lever *1* is turned about fixed axis *A* by a stop on the machine tool table, spool *2* is first stationary, owing to the provision of slot *a* in which pin *d* of the spool slides. After lever *1* reaches its extreme left-hand position, when its pointed lower end passes over the point of member *5*, which is actuated by spring *4*, spool *2* is shifted to its extreme left-hand position. At this, fluid under pressure is admitted to the other end of the power cylinder.

THREE-POSITION SPOOL-TYPE DIRECTIONAL VALVE MECHANISM FOR AIRCRAFT LANDING GEAR



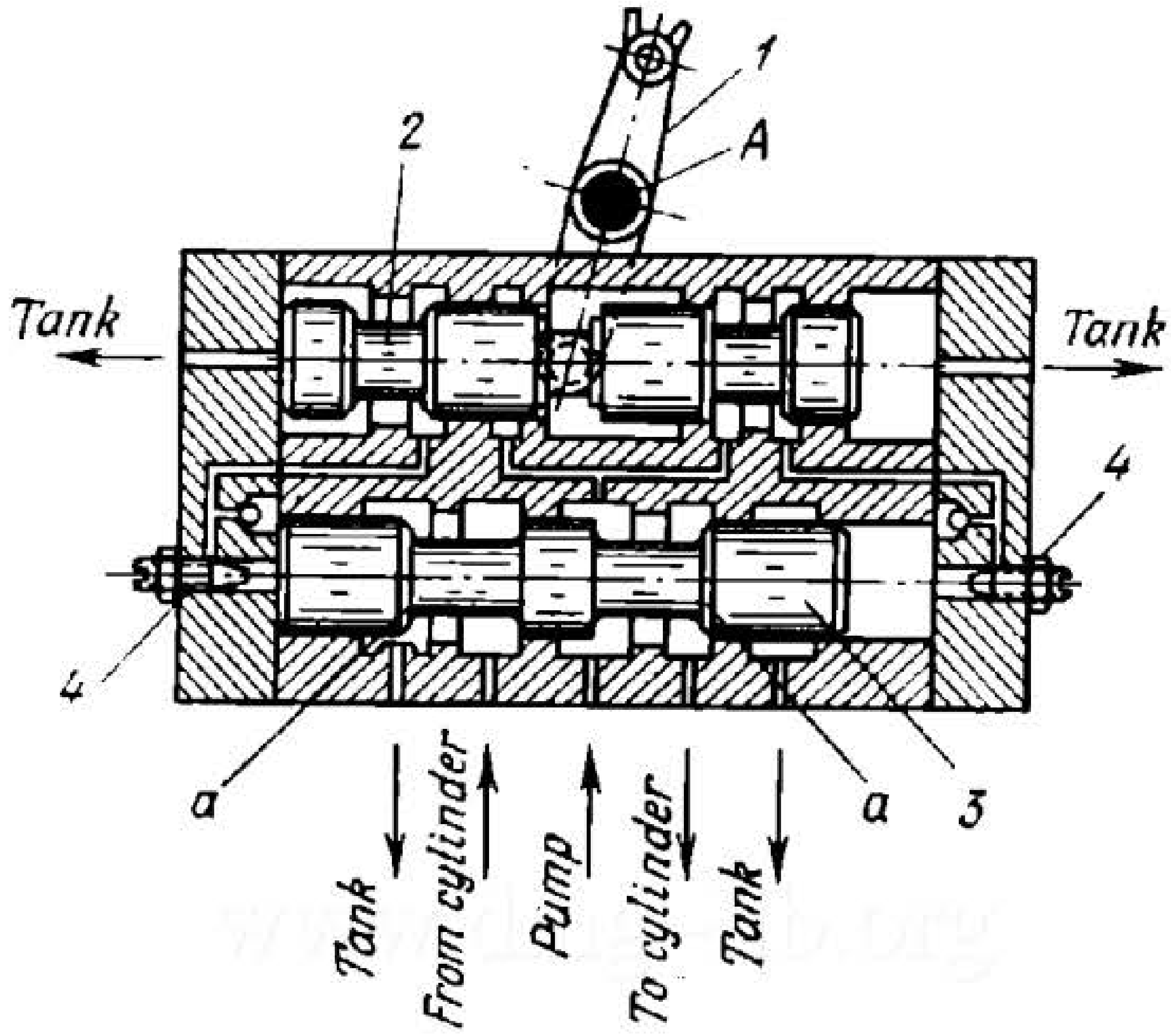
Fluid from the pump is delivered to port *1* and then passes through check valve *2*, a groove of spool *3* and port *4* to the power cylinder which retracts the landing gear. Fluid from the exhaust end of the cylinder passes from port *5* to port *6*, connected by grooves and passages *d* to the middle and extreme left ends of the valve and to the tank. When lever *7* is turned counterclockwise about fixed axis *A*, spool *3* is shifted to the left. At this, fluid under pressure is delivered through port *5* to the other end of the power cylinder, lowering the landing gear. Fluid from the exhaust end of the cylinder drains to the tank through port *6*. Port *8* serves to connect the exhaust ends of the power cylinders to the emergency tank used in emergency lowering of the landing gear by means of the manual emergency pump. In this case, lever *7* is shifted to the extreme right-hand position in which port *4* is connected through passages *d* to port *8* which leads to the emergency tank.

3917	LINKWORK MECHANISM OF A SPOOL-TYPE DIRECTIONAL VALVE FOR THE ELEVATOR OF AIRCRAFT	LHP FC



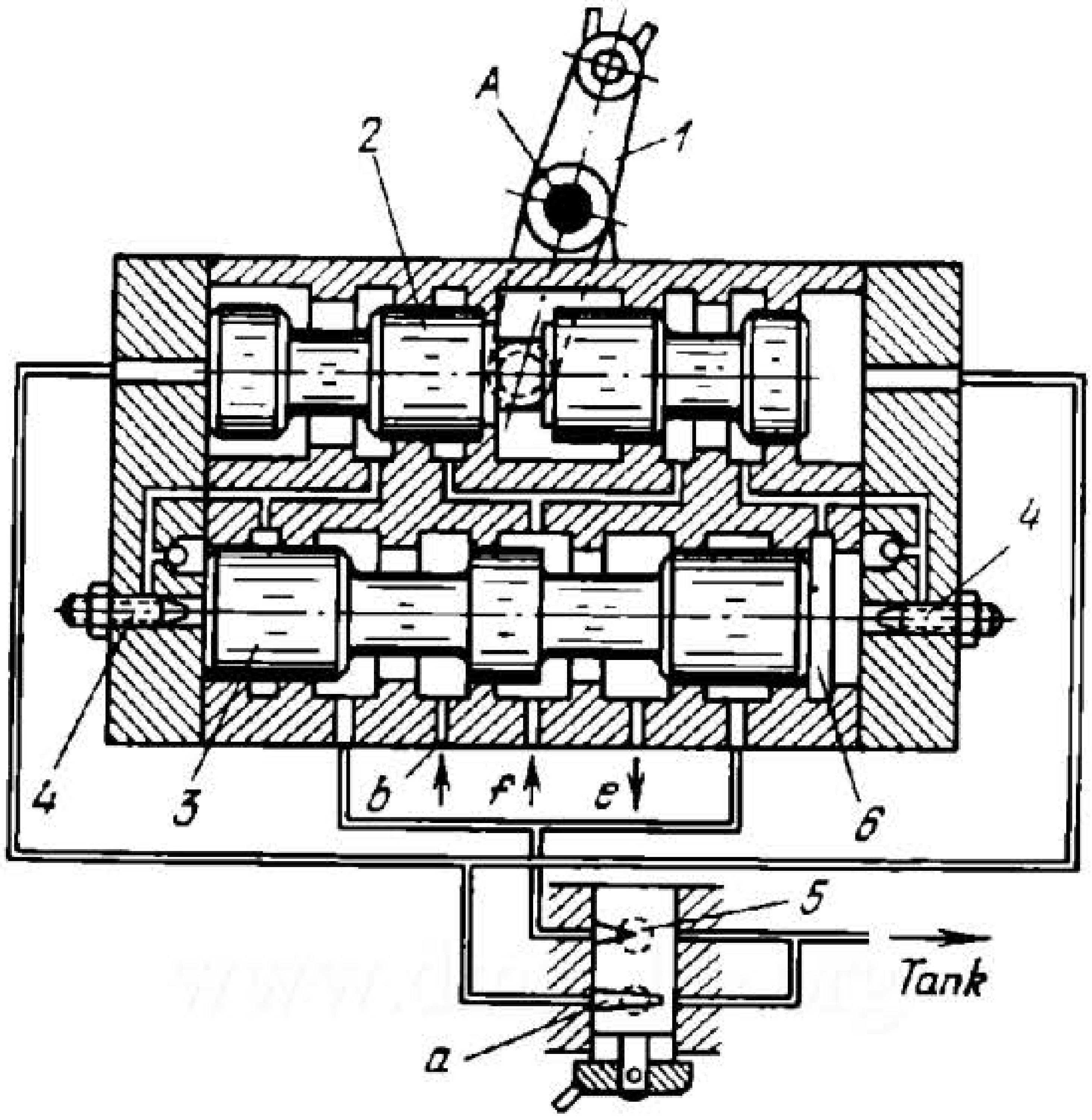
A double spool valve device is employed to control the elevator of aircraft. It consists of valve spool *4*, connected by links *9*, *8* and *7* to auxiliary valve *5*. This valve contains piston *1* with hollow rod *6*. Moving in hollow rod *6* is piston *2*, connected by flexible tie-rod *3* to the spindle of a gyroscope. Compressed air is admitted through a passage in the body of auxiliary valve *5* from where it passes through openings *a* and *d*, regulated by screws, into the upper and lower ends of valve *5*. From these ends, the compressed air can pass through passages in piston *1* to the upper and lower ends of hollow rod *6*. In the neutral position of piston *2*, both air input passages into hollow rod *6* are blocked off. Upon motion of the gyroscope spindle, piston *2* moves inside hollow rod *6* and connects one of the ends of valve *5* to the atmosphere. At this, piston *1* and rod *6* are moved by the compressed air. Their motion is transmitted through links *7*, *8* and *9* to valve spool *4* which controls the elevator. The motion of piston *1* continues until piston *2* blocks off the passages in piston rod *6*.

3918	LEVER MECHANISM OF A SPOOL-TYPE PILOT-OPERATED DIRECTIONAL VALVE	LHP FC



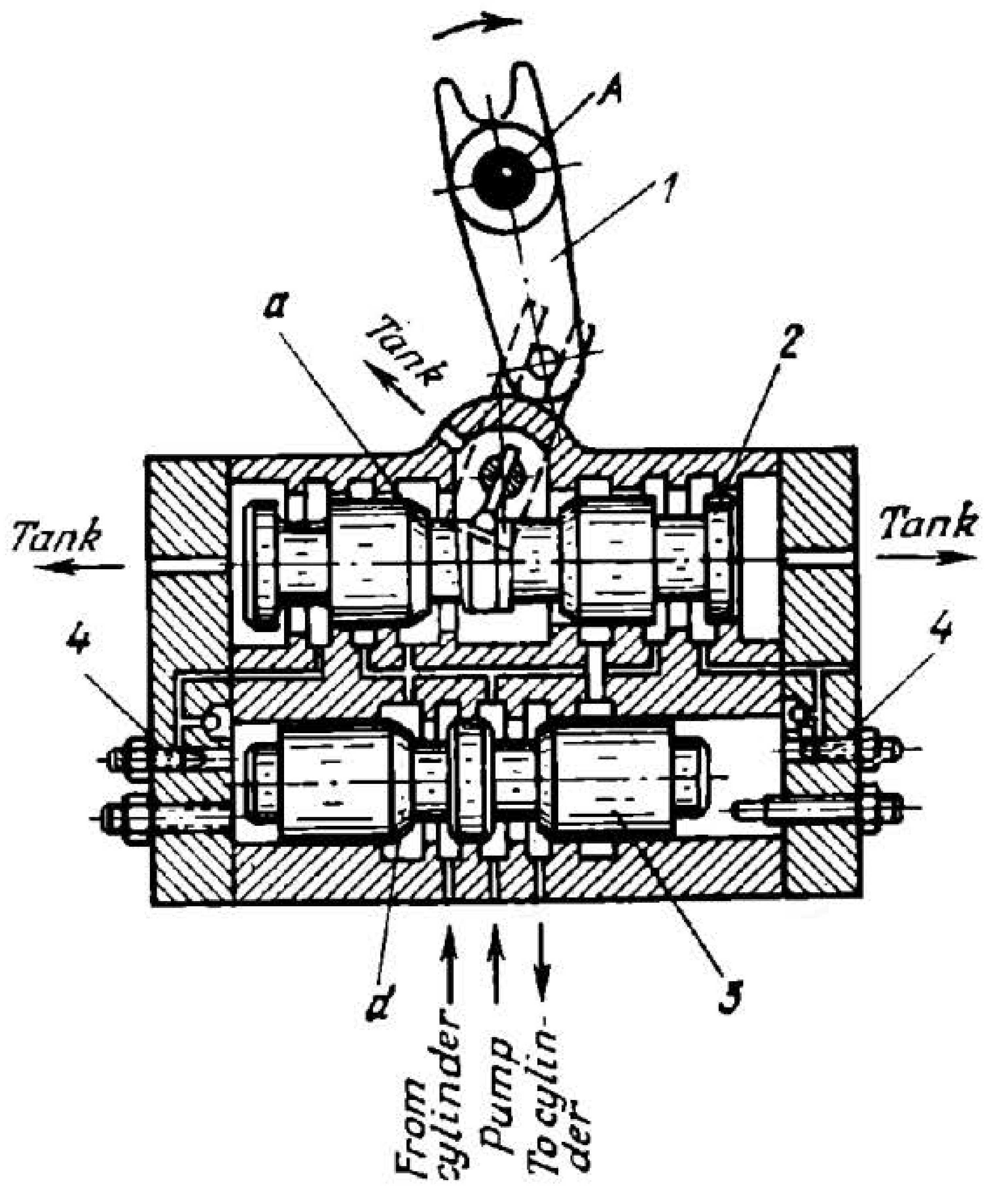
In the position shown, fluid under pressure, admitted into the directional valve, is delivered to the power cylinder. A part of the fluid is admitted into the housing of pilot valve spool *2* and from there, through one of the flow-control valves *4*, to the right end of spool *3*. Fluid from the exhaust end of the cylinder is drained through the valve to the tank. Braking of the machine tool table, linked to the piston of the power cylinder, is accomplished by cones *a* of spool *3* which throttle the fluid being drained from the cylinder. The velocity of the spool and, consequently, the braking conditions are varied by adjusting flow-control valves *4*. At a definite setting of the flow-control valve, the velocity of spool *3* and the braking time are constant for all table travel speeds. When lever *1* is turned about fixed axis *A*, pilot spool *2* is shifted to the right. At this, a part of the fluid under pressure is admitted to the left end of spool *3*, shifting it to the right as well. This delivers fluid under pressure to the other end of the power cylinder. The exhaust end of this cylinder is connected to the tank.

3919	LEVER MECHANISM OF A SPOOL-TYPE PILOT-OPERATED DIRECTIONAL VALVE	LHP FC



In the position shown, fluid under pressure, admitted into the directional valve through port *f*, is delivered to the power cylinder through port *e*. A part of the fluid is admitted into the housing of pilot valve spool *2* and from there, through one of the flow-control valves *4*, to the right end of spool *3*. Fluid from the exhaust end of the cylinder (through port *b*) is drained to the tank through valve *3* and flow-control valve *5* which regulates the speed of the machine tool table, linked to the piston of the power cylinder. The velocity of spool *3* and, consequently, the braking conditions are varied by adjusting flow-control valves *4*. Flow-control valve *5* has a supplementary throttling slit *a* through which fluid from the ends of pilot spool *2* is drained to the tank. When lever *1* is turned about fixed axis *A*, pilot spool *2* is shifted to the right. At this, a part of the fluid under pressure is admitted to the left end of spool *3*, shifting it to the right as well. During the first portion of its travel, until its end face blocks off fluid discharge from chamber *6*, spool *3* moves at higher velocity. In its right-hand position, spool *3* delivers fluid to the other end of the power cylinder. The exhaust end of the cylinder is connected to the tank.

3920	LEVER MECHANISM OF A SPOOL-TYPE PILOT-OPERATED DIRECTIONAL VALVE	LHP FC

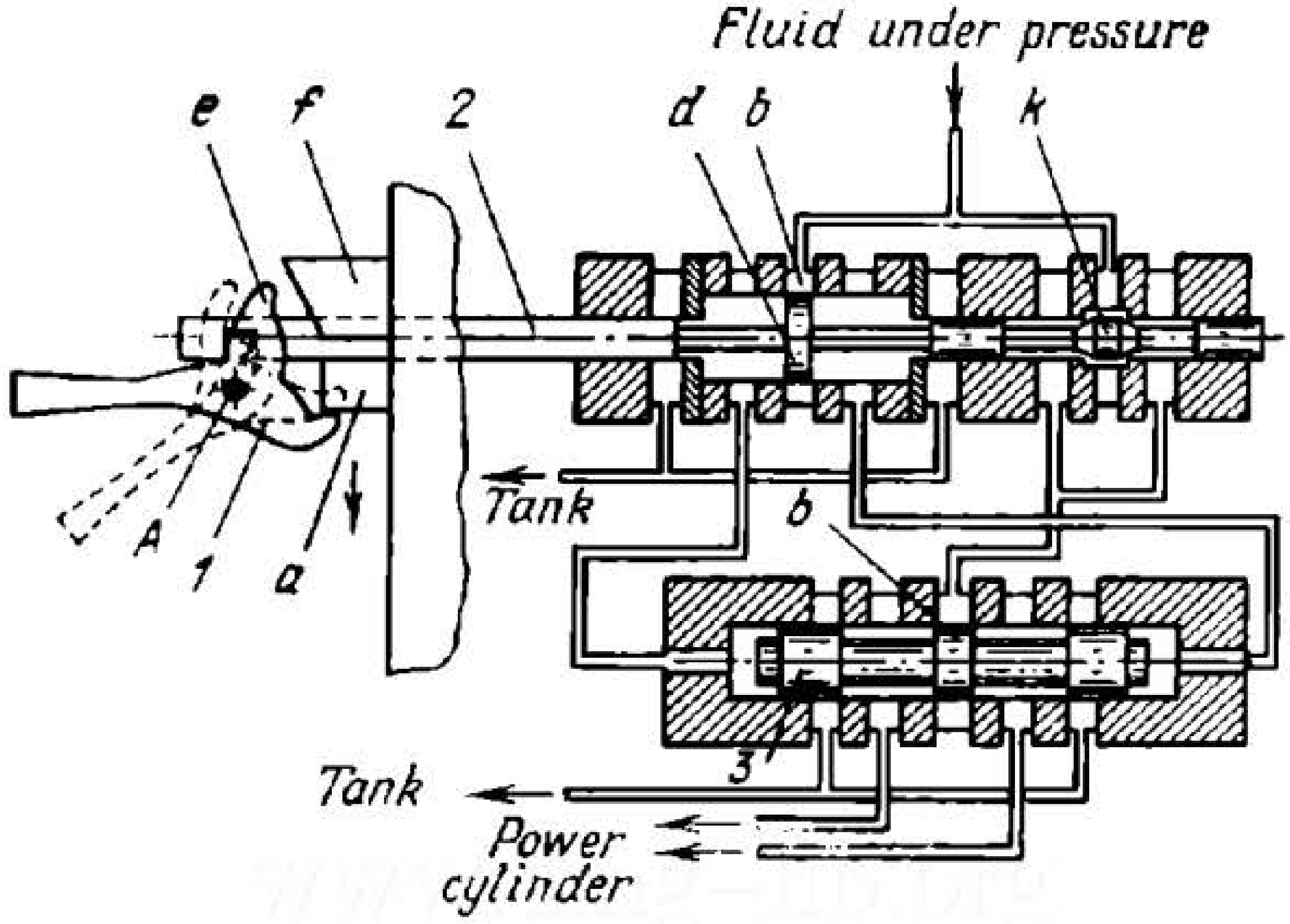


In the position shown, fluid under pressure, admitted into the housing of directional valve spool *3*, is delivered to the power cylinder. A part of the fluid is admitted into the housing of pilot valve *2* and from there, through one of the flow-control valves *4*, to the right end of spool *3*. Fluid from the exhaust end of the cylinder is drained through grooves of valve spools *3* and *2* to the tank. Braking of the machine tool table, linked to the piston of the power cylinder, is accomplished by cones *a* and *d* which throttle the fluid being drained to the tank. When lever *1* is turned about fixed axis *A*, pilot spool *2* is shifted to the right. At this, a part of the fluid under pressure is admitted to the left end of spool *3*, shifting it to the right as well. In its right-hand position, spool *3* delivers fluid to the other end of the power cylinder. The exhaust end of the cylinder is connected to the tank.

3921

LEVER MECHANISM OF A SPOOL-TYPE PILOT-OPERATED DIRECTIONAL VALVE

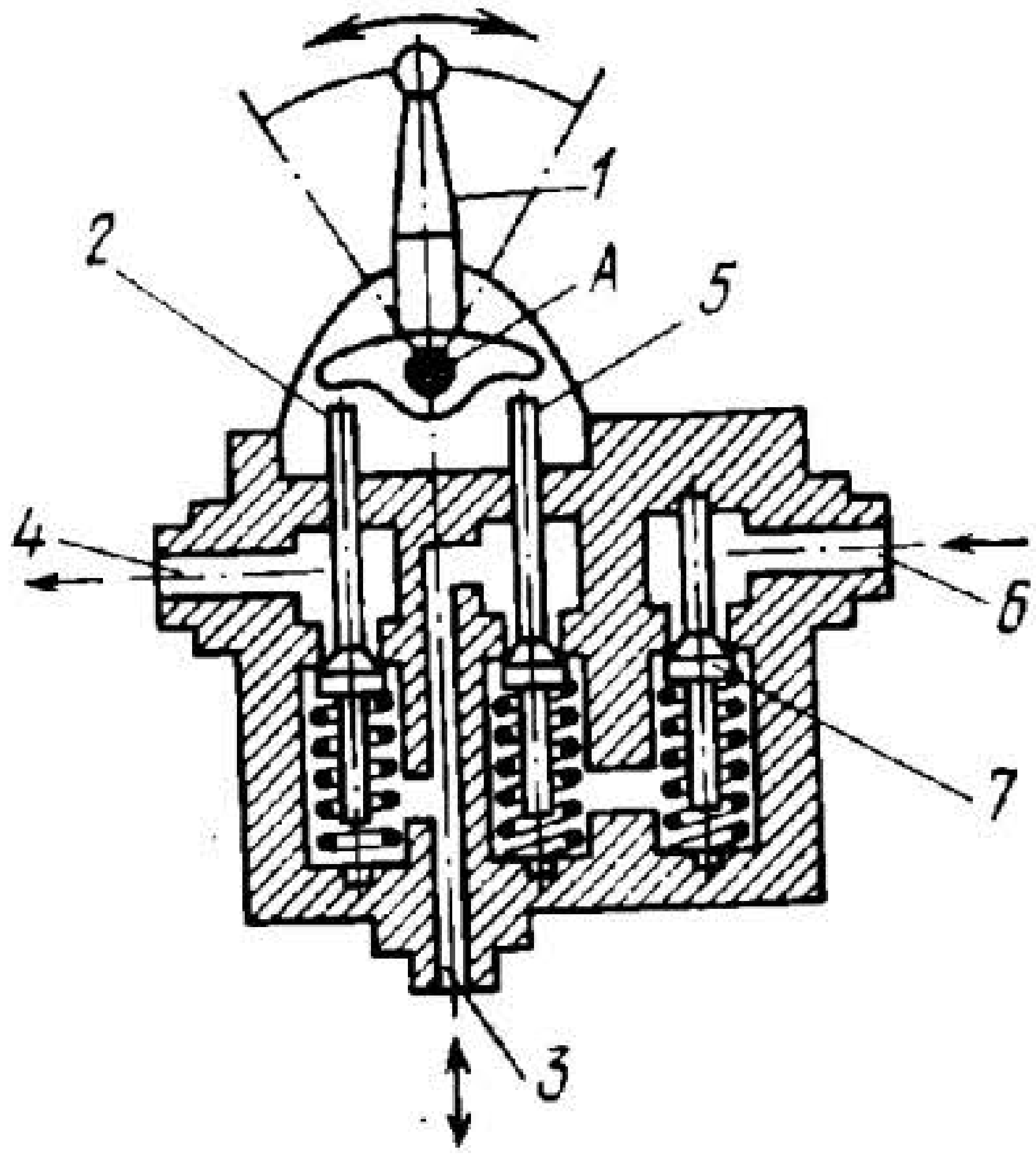
LHP
FC



As the machine tool table travels downward, stop a of the table trips two-arm lever 1 which turns about fixed axis A, turning the lever clockwise. At this, stem 2 of the pilot valve is shifted to the right and, owing to the special shape of land k, the delivery of high-pressure fluid, passing through the grooves of valve spool 3 to the working end of the power cylinder, is gradually reduced, thereby reducing the speed of the table. As the pilot valve spool is shifted, high-pressure fluid, admitted through port b, is delivered to the left end of spool 3, shifting it to the right as well. At this, the table reverses and begins to travel upward. Fluid from the right end of spool 3 is drained to the tank. At the moment of reversal, the motion of pilot valve spool 2 to the right is restricted because lug e of lever 1 contacts stop f of the table. As the table continues upward motion, stop f releases lever 1, valve stem 2 is shifted to the left by the action of fluid on spool land d. At this, spool 3 also shifts to the left, increasing fluid delivery to the power cylinder and thereby accelerating the table after reversal.

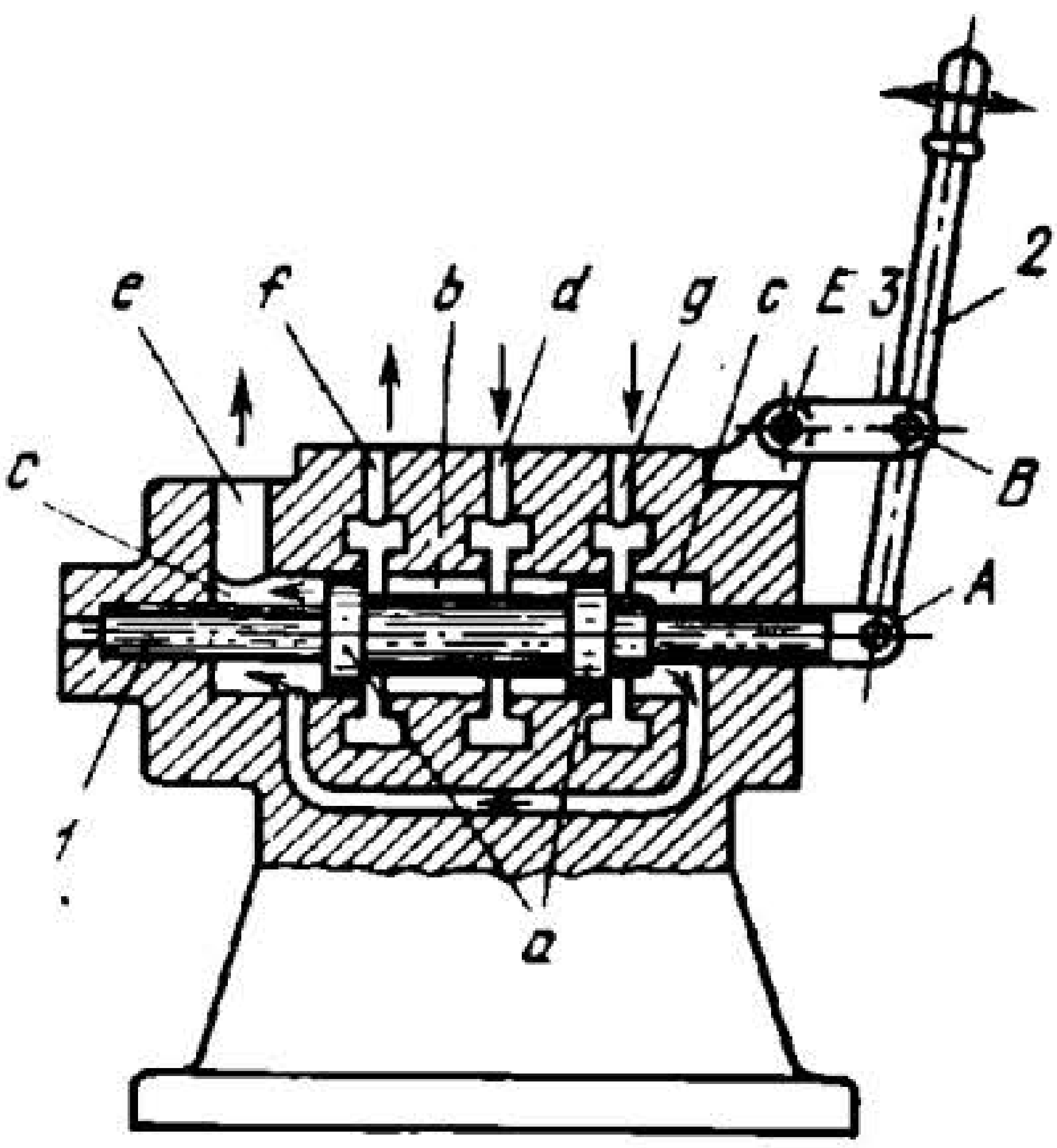
3922	LEVER MECHANISM OF A POPPET-TYPE DIRECTIONAL VALVE	LHP FC

When handle 1 is turned clockwise about fixed axis A, valve 5 is opened. At this, fluid, delivered by the pump to port 6, opens check valve 7 and is admitted to the working main through port 3. When handle 1 is turned counterclockwise, valve 2 is opened. At this, fluid from the working main is drained through ports 3 and 4 to the tank.

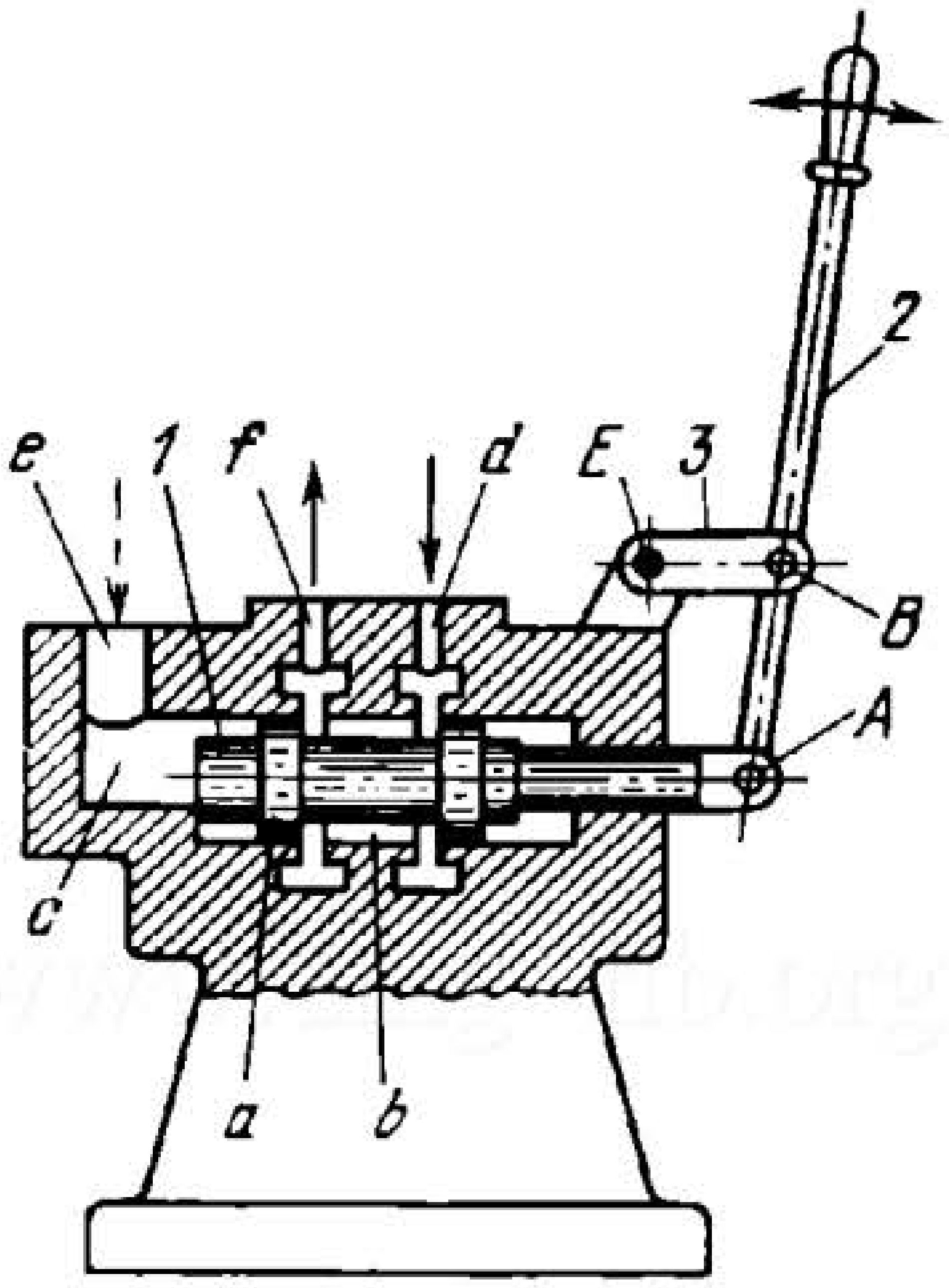


3923	LEVER MECHANISM OF A SPOOL-TYPE DIRECTIONAL VALVE	LHP FC

Valve spool 1 is shifted by lever 2 which is connected by turning pairs A and B to spool 1 and to link 3. Link 3 turns about fixed axis E. Lands a of the spool divide the inner space of the valve into two chambers: chamber b, connected by port d to the high-pressure main, and chamber c, connected by port e to the low-pressure main. In the extreme left-hand position of the spool (as shown), fluid from the high-pressure main is directed to port f, and that from the low-pressure main to port g. In the extreme right-hand position of the spool, fluid from the high-pressure main is directed to port g and that from the low-pressure main to port f.

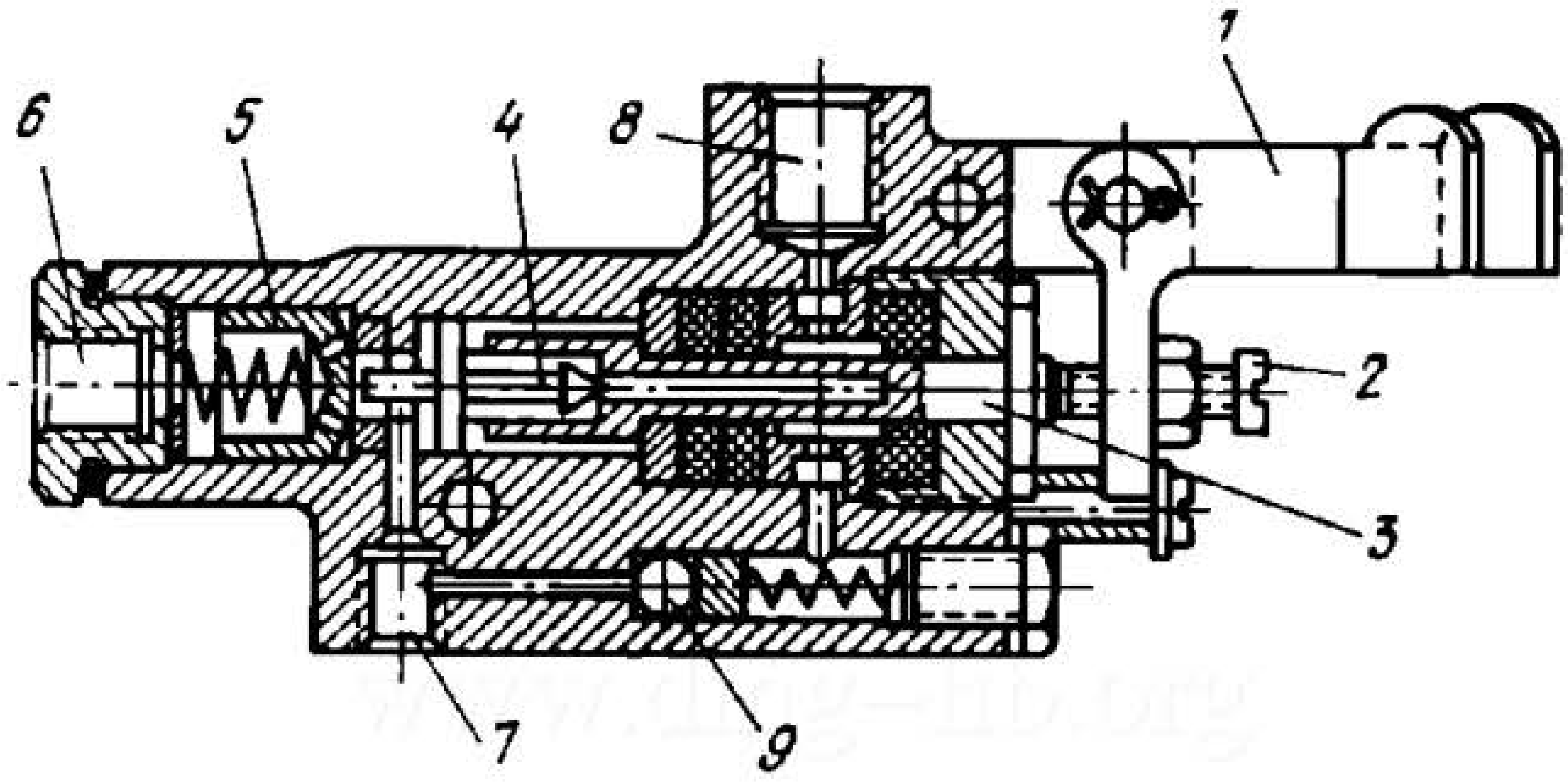


3924	LEVER MECHANISM OF A SPOOL-TYPE DIRECTIONAL VALVE	LHP FC



Valve spool *1* is shifted by lever *2* which is connected by turning pairs *A* and *B* to spool *1* and to link *3*. Link *3* turns about fixed axis *E*. Lands *a* of the spool divide the inner space of the valve into two chambers: chamber *b*, connected by port *d* to the high-pressure main, and chamber *c*, connected by port *e* to the low-pressure main. When spool *1* is shifted to its extreme left-hand position (as shown), fluid from the high-pressure main is directed to port *f*. In the extreme right-hand position of the spool, fluid from the low-pressure main is directed to port *f*.

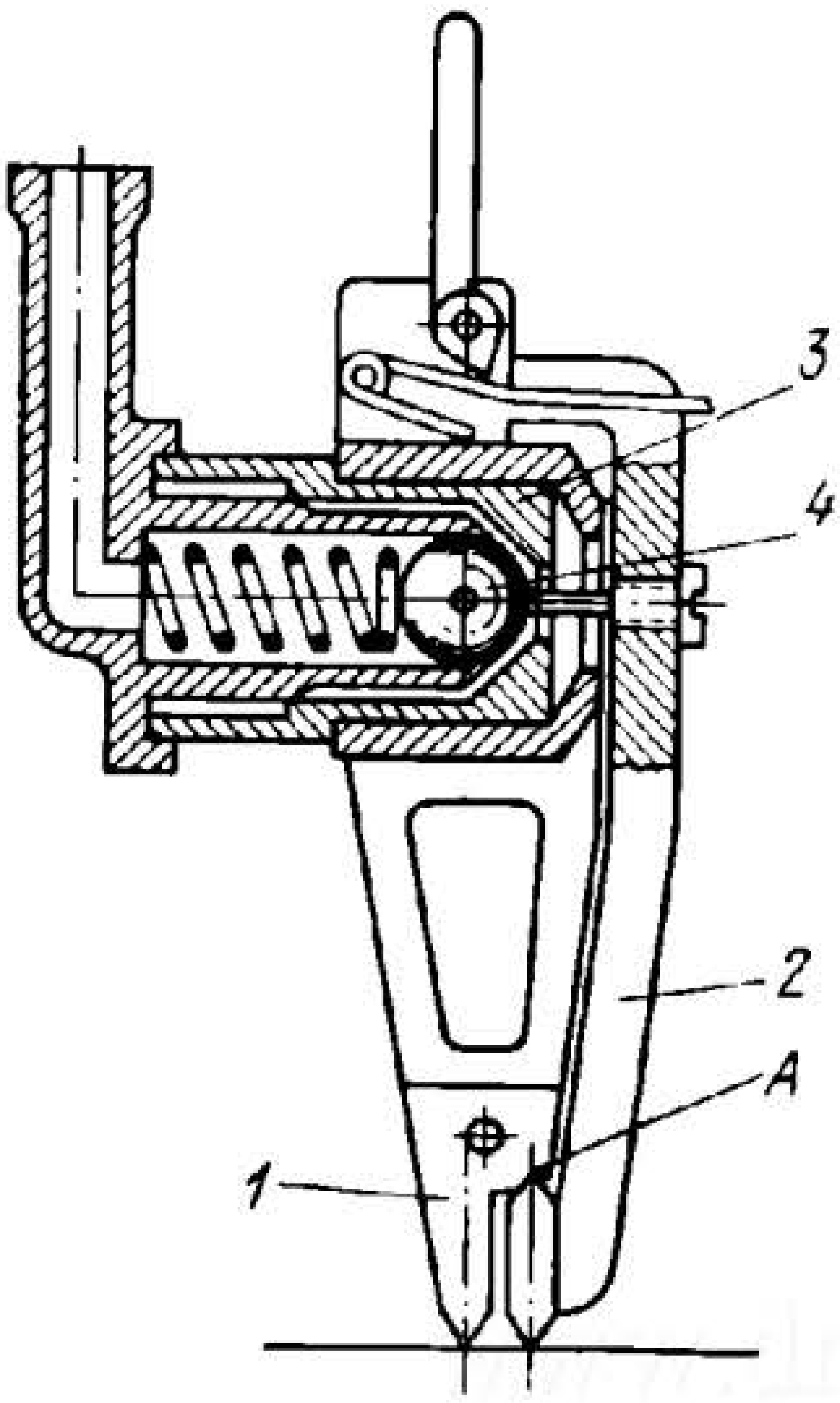
3925	LEVER MECHANISM OF A DIRECTIONAL VALVE FOR RADIATOR DAMPER CONTROL	LHP FC



When lever *1* turns clockwise (opening of the radiator dampers), screw *2* pushes rod *3* which runs up against valve member *4*. The right end of valve member *4* closes the internal passage of rod *3* and its left end opens valve *5*. After this, fluid flows from port *6* to port *7*. When lever *1* returns to its initial position (closing of the radiator dampers), fluid is admitted from port *7* to the internal passage of rod *3* and drains back to the tank through port *8*. Check valve *9* allows surplus fluid from port *7* to flow to port *8* when valve *4* is closed.

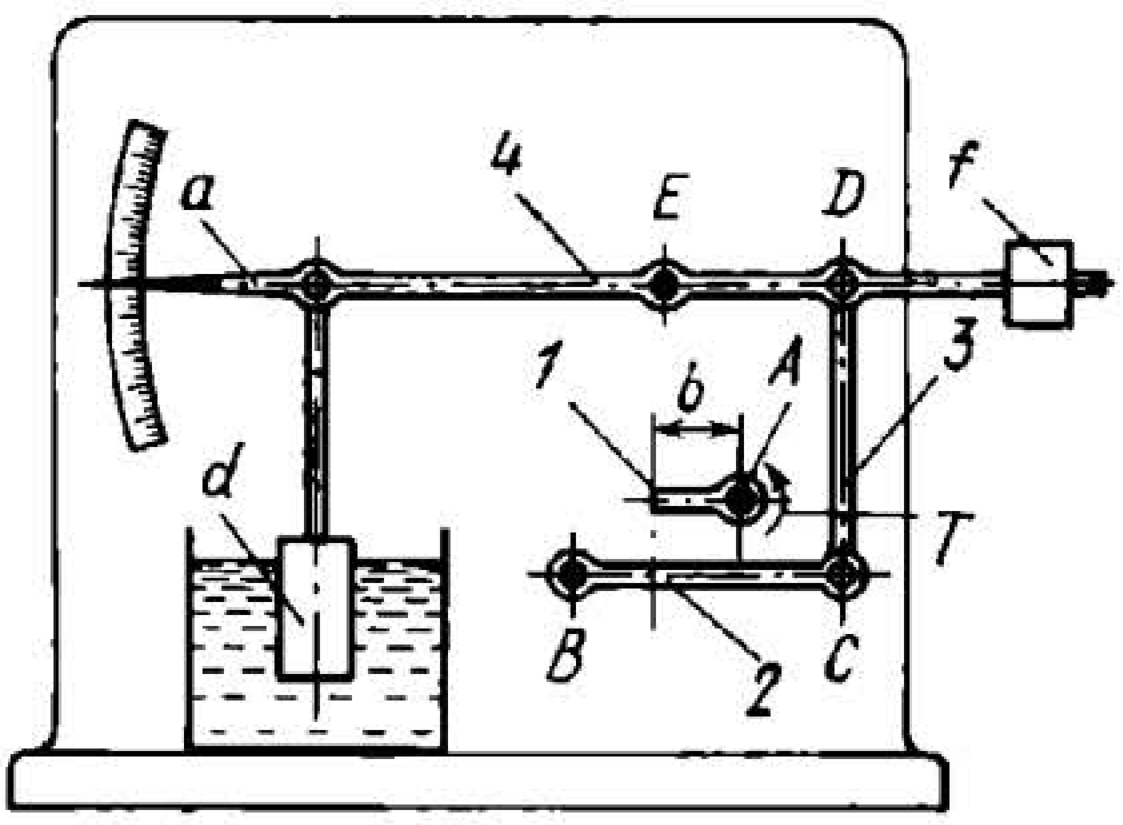
5. MECHANISMS OF MEASURING AND TESTING DEVICES (3926 through 3942)

3926	LEVER MECHANISM OF A PNEUMATIC TENSOMETER	LHP M



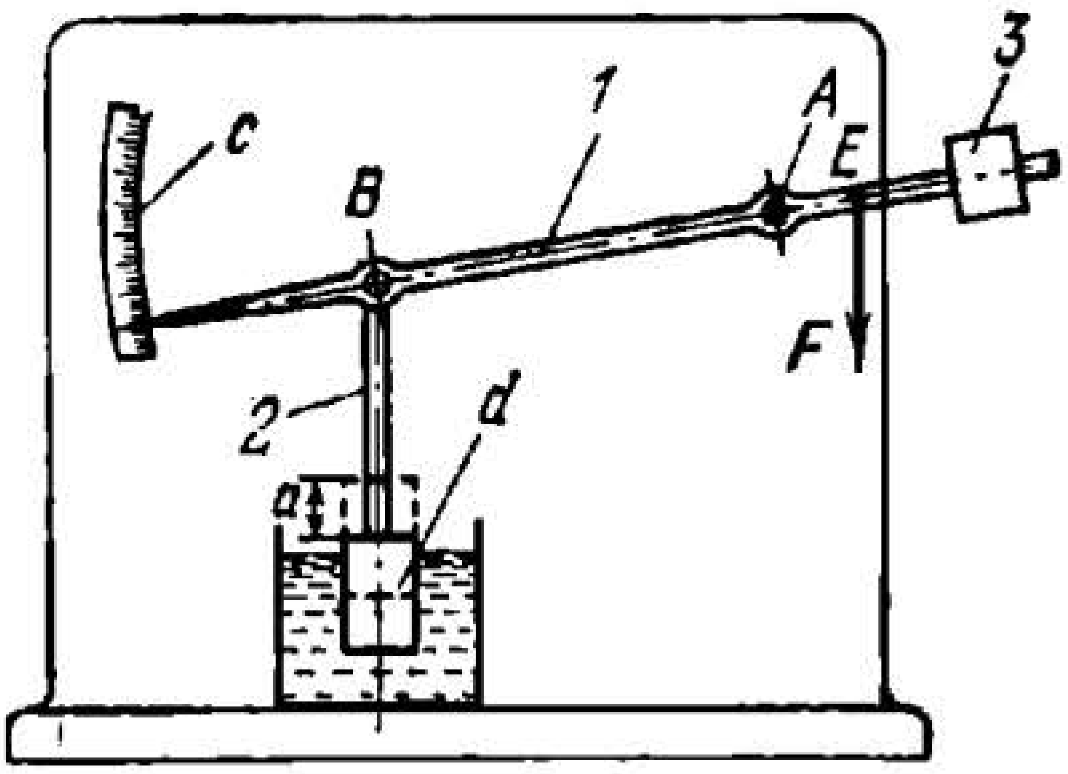
Ball *4* closes the orifice of bushing *3* to which compressed air is delivered. Upon deformation of the test specimen, on which the legs of the tensometer (strain gauge) rest, movable lever *2*, which can turn about point *A* of body *1*, forces back ball *4* so that air is released from bushing *3* through the annular clearance. The pressure inside bushing *3*, which is measured, depends upon the displacement of movable lever *2*.

3927	LEVER MECHANISM OF A CONTINUOUS-ACTION DYNAMOMETER	LHP M



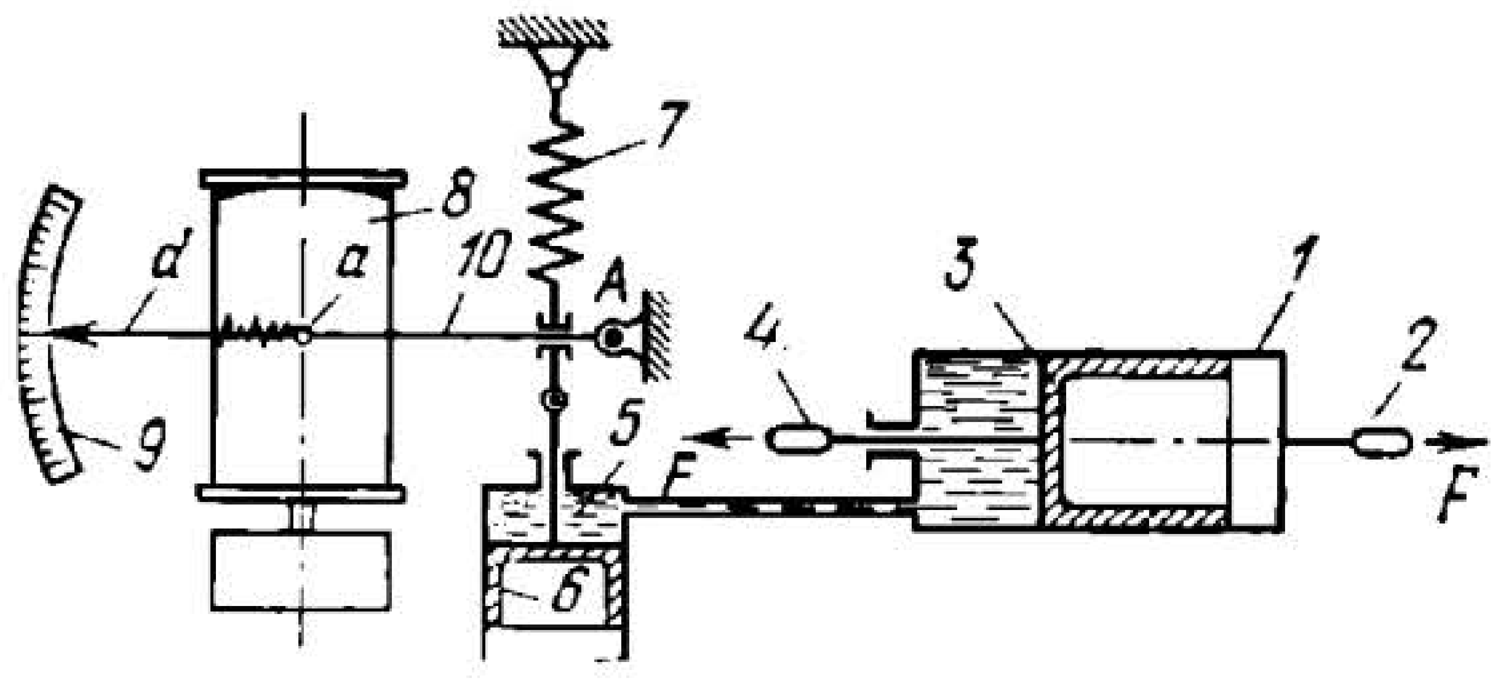
The torque *T* of shaft *A* being measured is transmitted by lever *1*, rigidly mounted on shaft *A*, to a system of levers *2*, *3* and *4* with counterbalancing weight *d*, immersed in a vessel with water. The value *T* of the torque is indicated by hand *a* on a scale. Before the test, hand *a* is zeroed by means of weight *f*.

3928 LEVER MECHANISM OF A CONTINUOUS-ACTION DYNAMOMETER — LHP M



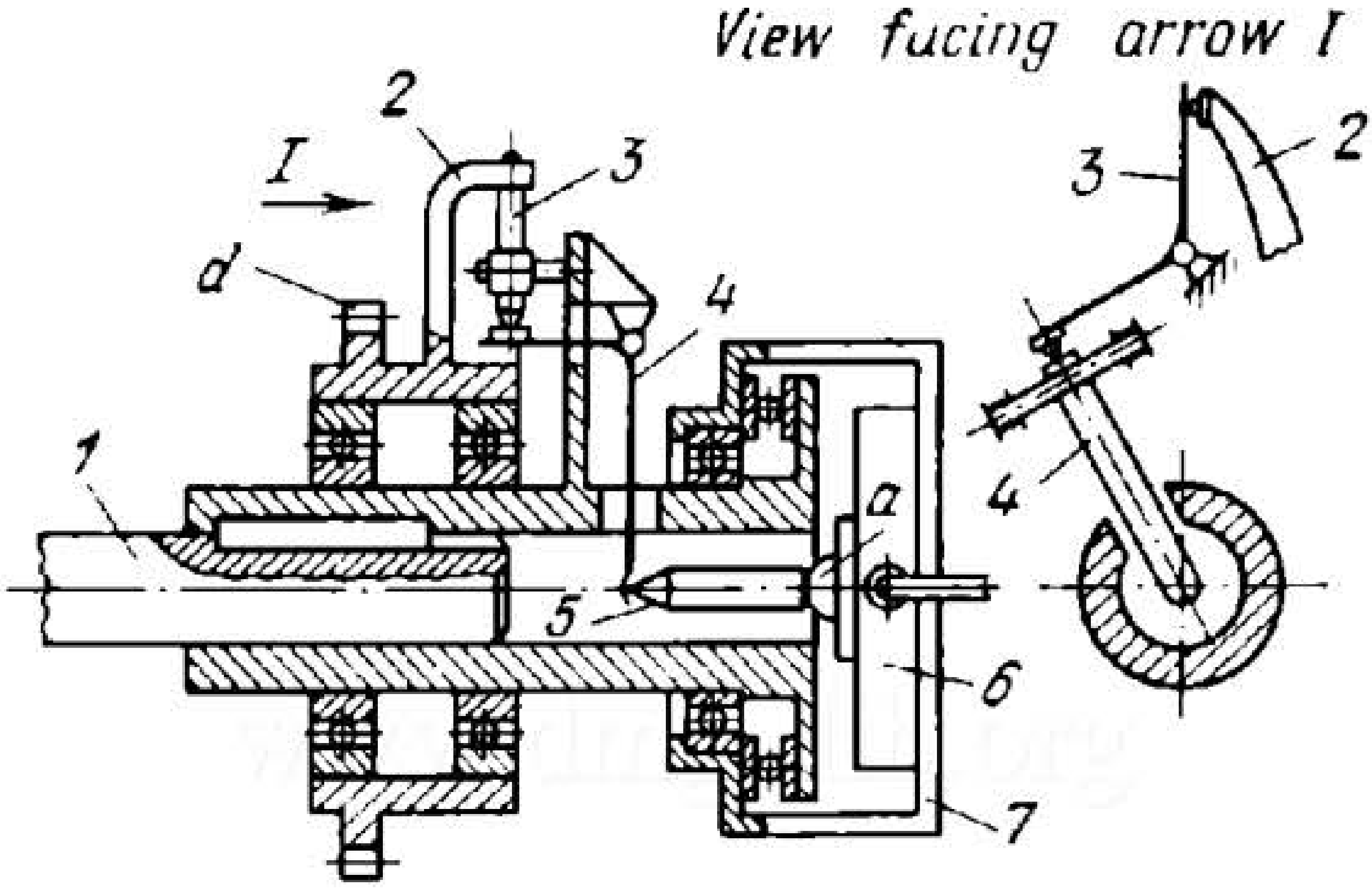
Lever *1* turns about fixed axis *A*. At point *B*, link *2* with weight *d* is suspended from lever *1*. At point *E*, the force *F* to be measured is applied to lever *1*. Force *F* turns lever *1* about axis *A*, lifting counterbalancing weight *d* which is immersed in a vessel with water. The force *F* is proportional to the height *a* that the weight is raised. Force *F* is indicated on scale *c*. Before the test, the hand is zeroed by means of weight *3*.

3929 LEVER MECHANISM OF A HYDRAULIC TENSION DYNAMOGRAPH — LHP M



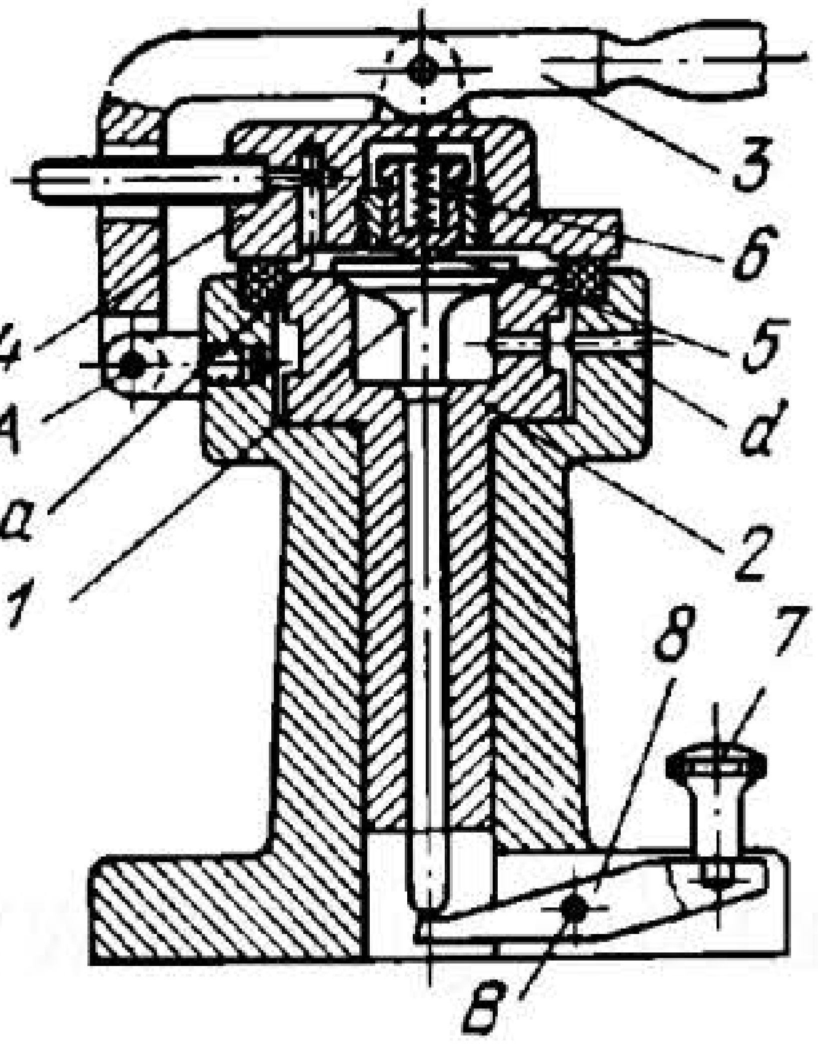
Cylinder *1* is rigidly linked to link *2* and the rod of piston *3* to link *4*. The liquid in the cylinder is subject to a pressure which corresponds to the tensile force *F* applied to links *2* and *4*. The liquid enters cylinder *5* and moves piston *6* downward, stretching spring *7*. The extension of spring *7* is registered by pin *a*, mounted on lever *10* which turns about fixed axis *A*. Hand *d* indicates the magnitude of force *F* on scale *9*, while pin *a* plots a graph of the force on chart paper attached to revolving drum *8*.

3930	LEVER MECHANISM OF A HYDRAULIC ROTARY DYNAMOGRAPH	LHP M



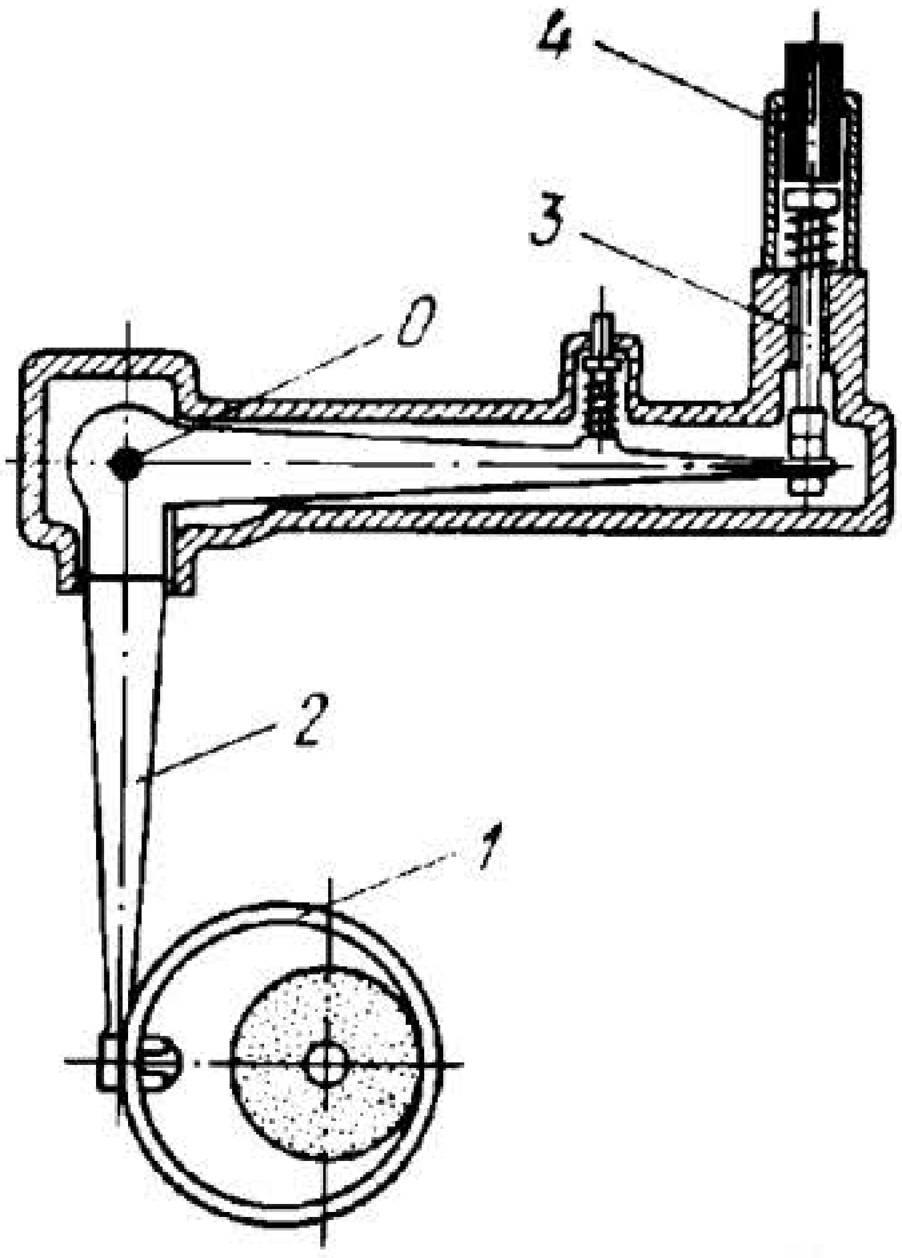
The dynamograph is mounted on drive shaft *1* of the machine and is furnished with pulley or sprocket *d* which transmits torque to the driven shaft through lever *2*. Lever *2* turns bell-crank lever *3*, and lever *3* turns bell-crank lever *4*. Axial force, acting on rod *5*, is transmitted to ball *a* of load cell *6* which is mounted on fixed yoke *7*. The pressure of the liquid in load cell *6* is indicated by a pressure gauge.

3931	LEVER MECHANISM OF AN INSTRUMENT FOR CHECKING VALVE FACES	LHP M



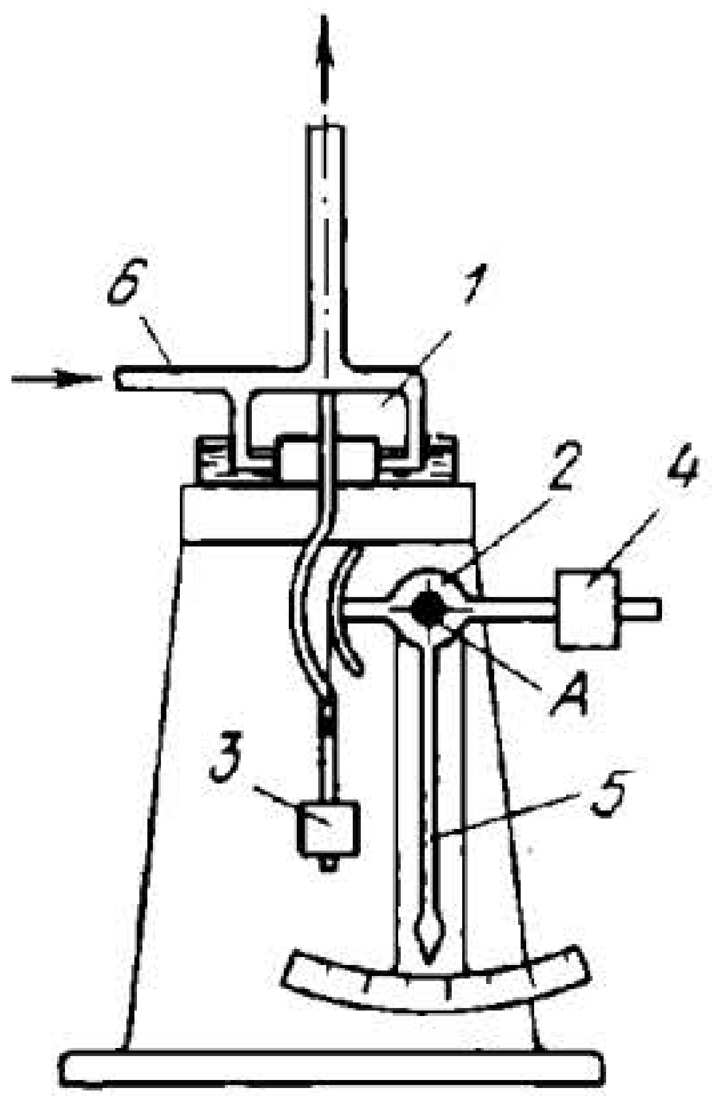
Poppet valve *1* is inserted into standard sleeve *2*, which is mounted in the body of the instrument. The valve face is pressed into the conical seat by lever *3*, which turns about fixed axis *A* and contacts the valve through cover *4* and thrust member *5*. Member *5* is loaded by spring *6*. Compressed air is delivered from the pneumatic measuring device to chamber *a* of cover *4*. If the face of the valve is concentric to its stem, no air passes through the joint between the valve face and seat in the sleeve. This raises the pressure in chamber *a*, as indicated by the pressure gauge of the instrument. In case of runout of the valve face with respect to its stem, air leaks out between the face and seat joint and escapes to the atmosphere through hole *d*. At this, the pressure drops in chamber *a*. When knob *7* is depressed, lever *8*, turning about fixed axis *B*, lifts out the tested valve.

3932	LEVER MECHANISM FOR GAUGING AN INSIDE DIAMETER DURING A GRINDING OPERATION	LHP M



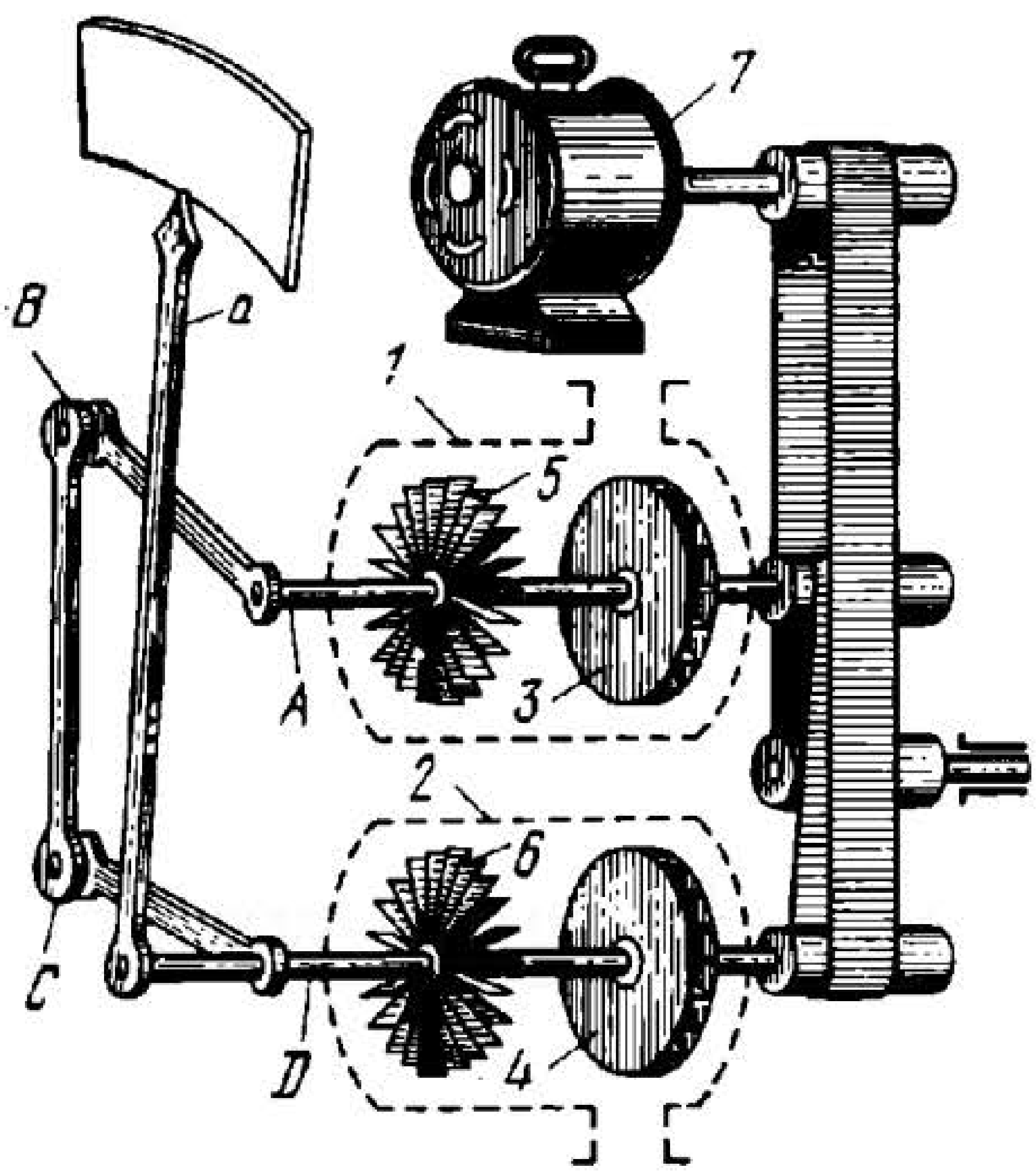
As the size of workpiece *1* changes during internal grinding, lever *2* turns about fixed axis *O* and changes the position of plunger *3* with respect to nozzle *4* of the measuring head to which compressed air is delivered. The pressure in the instrument (not shown) depends upon the clearance between the face of the nozzle and plunger *3*. This clearance depends upon the size of the hole being ground.

3933	LEVER MECHANISM OF A GAS BALANCE FOR CHECKING DENSITY	LHP M



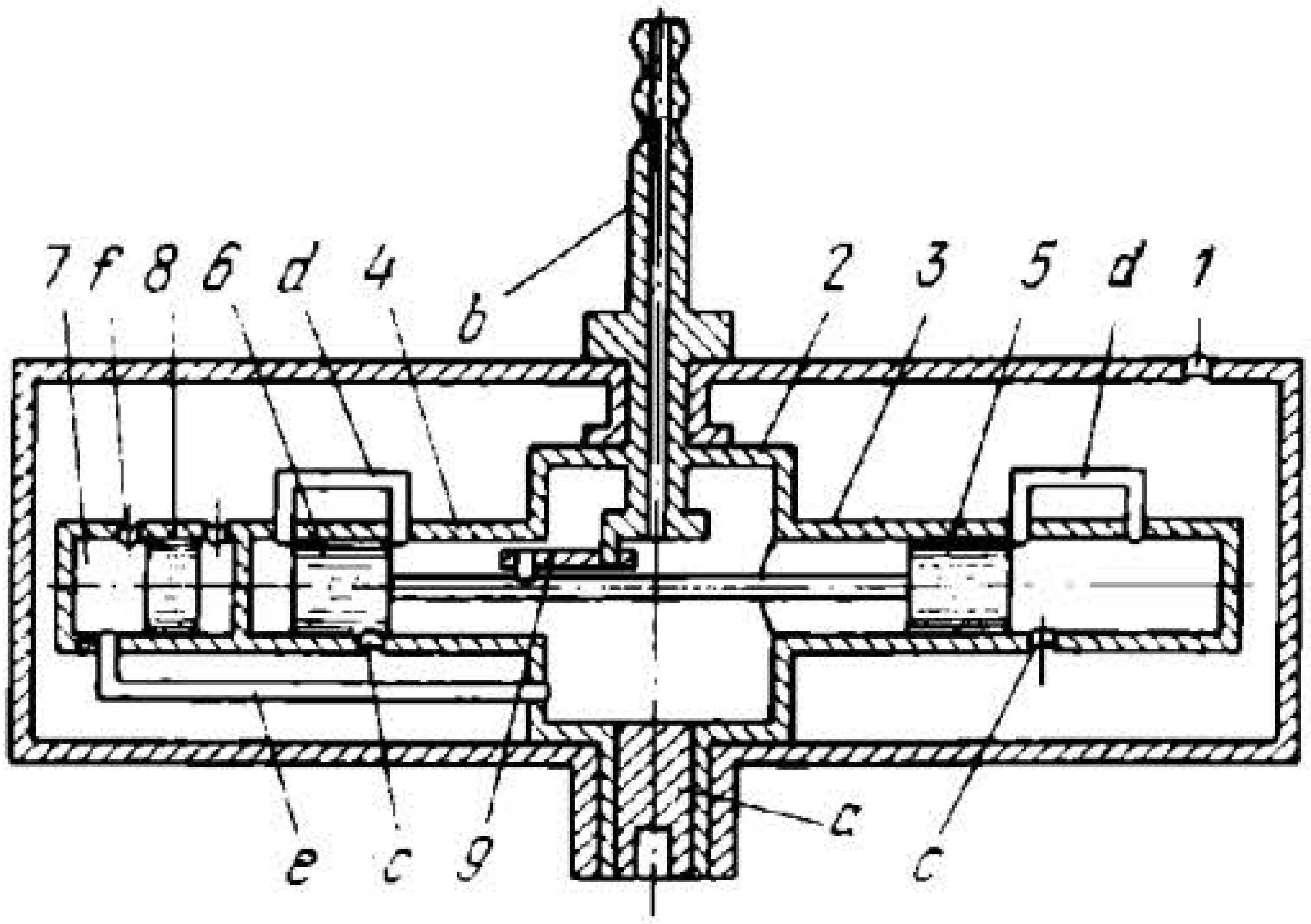
The gas to be checked is admitted through tube *6*. As the space above bell-shaped member *1* is filled with the gas, the pressure inside and outside the member differs. As a result, member *1* and weight *3* are displaced vertically. At this, hand *5*, turning about fixed axis *A*, indicates the density of the gas being checked. Weight *3* is connected by a flexible link to lever *2*. Weight *4* keeps the flexible link taut.

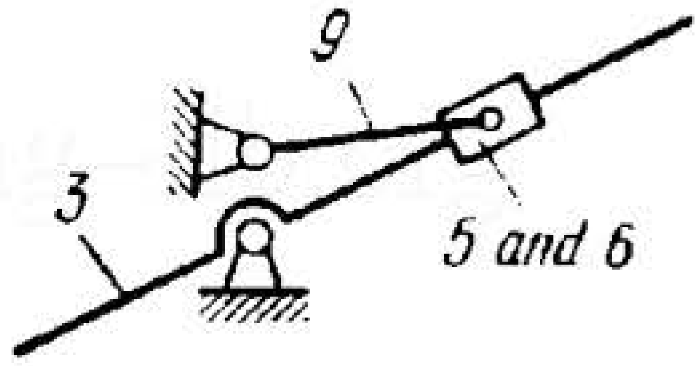
3934	LINKWORK MECHANISM OF A GAS ANALYZER	LHP M



The gas being analyzed for CO_2 and the air are brought into rotary motion in the gas and air chambers, *1* and *2*, by fans *3* and *4* which are driven in opposite directions by electric motor *7*. Shafts *A* and *D* of the gas and air impellers, *5* and *6*, are not linked to the fan shafts, but are linked together by four-bar rocker arm linkwork *ABCD*. Mounted on shaft *D* of air impeller *6* is hand *a*. The pressure produced by the fans in the gas and air chambers is transmitted to the impellers which tend to rotate in opposite directions. Since the specific mass of the CO_2 in the gas being analyzed is greater than that of air, the torque in the gas chamber is greater than that in the air chamber, and the hand of the instrument is deflected in one direction. The deflection of the hand corresponds to the content of CO_2 in the analyzed gas. The instrument is zeroed by passing air through both chambers.

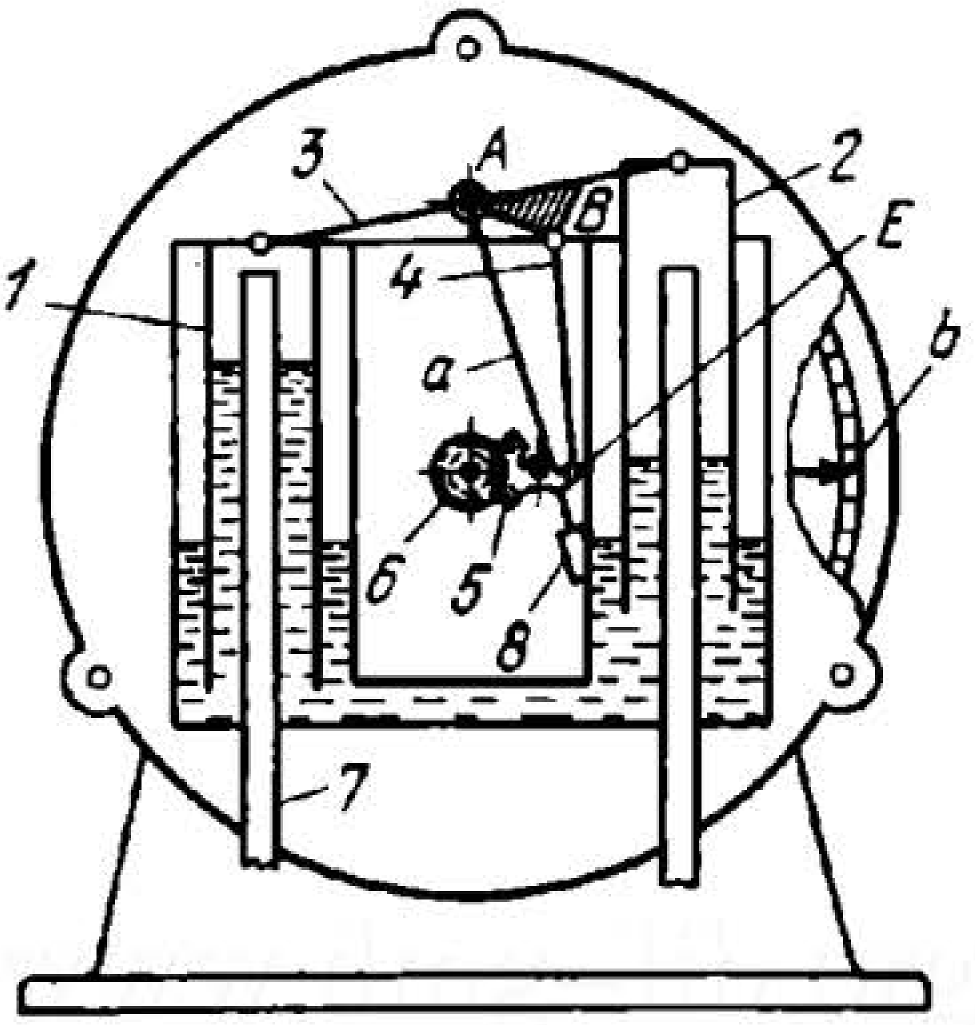
3935	LEVER MECHANISM OF A PNEUMATIC TACHOMETER	LHP M





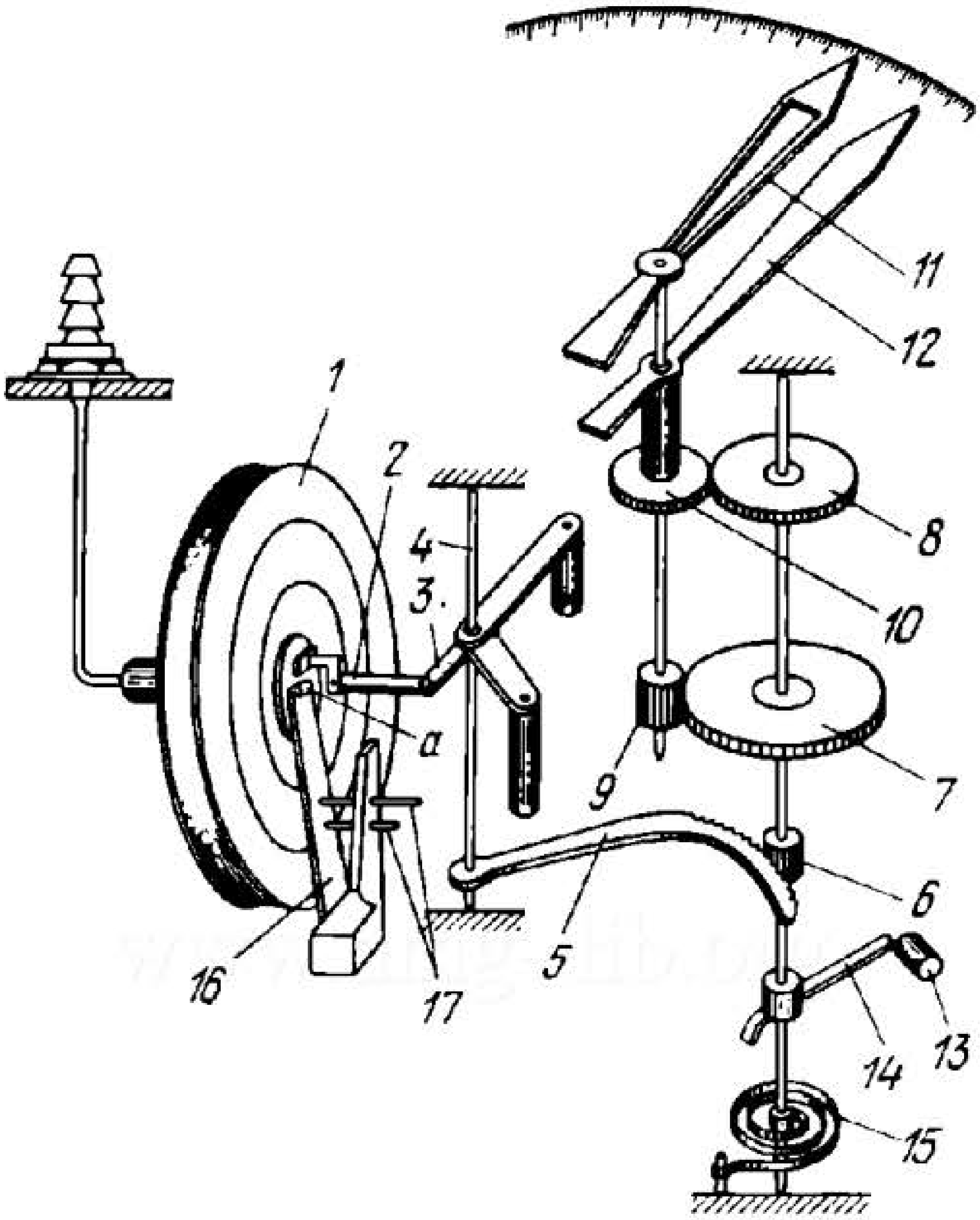
Chamber *2*, with two cylinders, *3* and *4*, rotates in stationary housing *1*. At one end, chamber *2* has shank *a* by means of which it is driven by the shaft whose speed is to be measured. Fitted into the other end of chamber *2* is stationary nipple *b* from which the pressure developed in the chamber is transmitted to a pressure gauge with a scale. Stationary nipple *b* has a pin connected by a turning pair to crank *9* which reciprocates the rod with pistons *5* and *6* when chamber *2* rotates (see kinematic diagram). Upon reciprocation of pistons *5* and *6*, air drawn in through ports *c* is delivered through tubes *d* to chamber *2*. From chamber *2* air passes through tube *e* to chamber *7* in which piston *8* slides freely. The pressure of the entering air tends to shift piston *8* to the right to open port *f* for releasing the air. On the other hand, centrifugal force tends to move piston *8* to the left to close port *f*. Consequently, the pressure established in chamber *7* and in chamber *2* is proportional to the centrifugal force of piston *8*, i.e. to the square of the speed of shaft being tested.

3936	LEVER MECHANISM OF A BELL-TYPE DRAUGHT GAUGE	LHP M



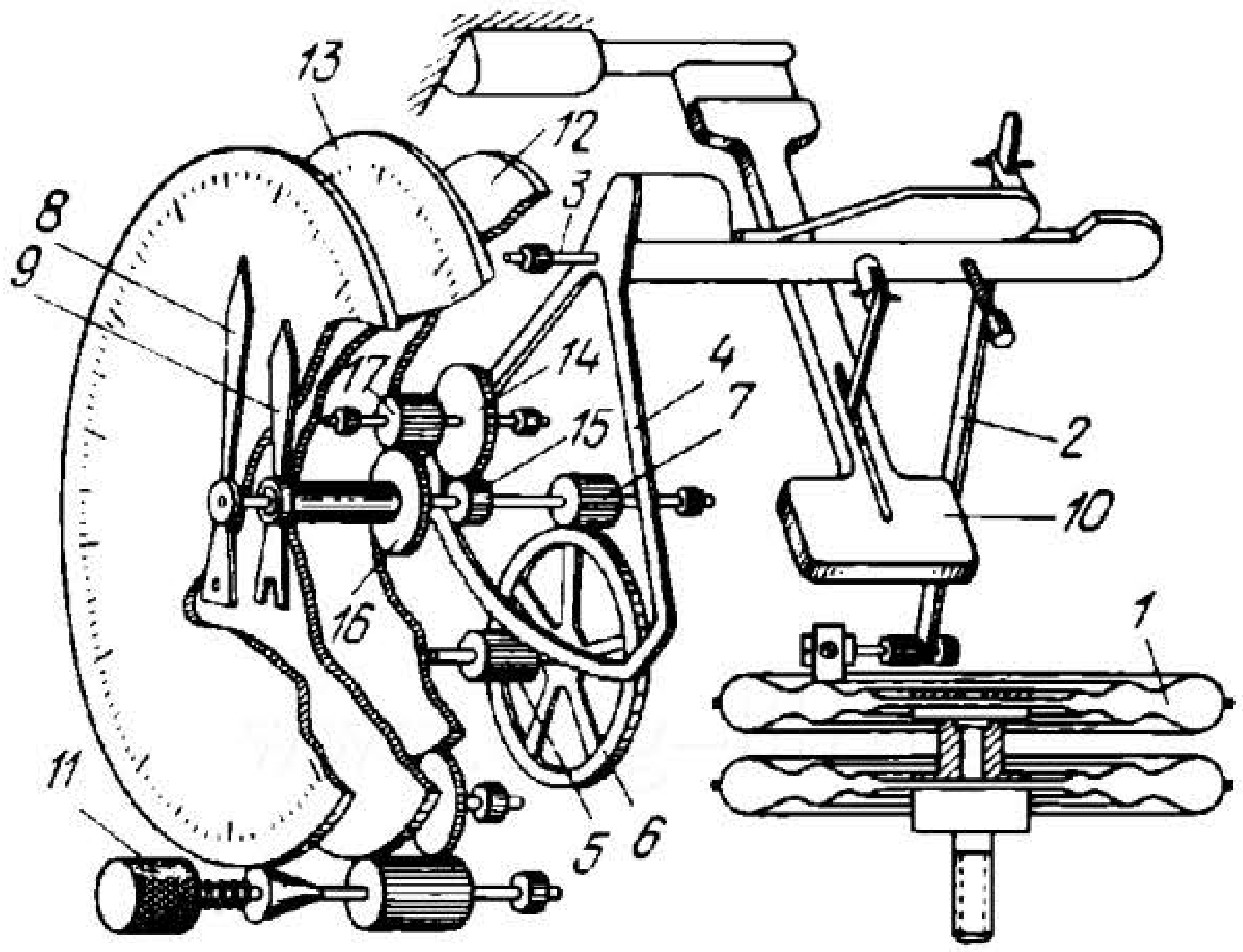
The instrument consists of two bell-shaped members, 1 and 2, suspended from a triple-arm lever 3 which turns about fixed axis A. Members 1 and 2 are immersed in two communicating vessels holding a liquid. When the space under a bell-shaped member is connected by tube 7 to the place where the measurement is to be made, the pressure under the member displaces it. This turns lever 3 whose rotation is transmitted through tie-rod 4, connected by turning pairs B and E to lever 3 and segment gear 5, and meshing gears 5 and 6 to hand b of the instrument. Weight 8, mounted on arm a of lever 3, stabilizes the motion of this lever.

3937	LEVER MECHANISM OF A TWO-HAND AIRCRAFT SPEED INDICATOR	LHP M



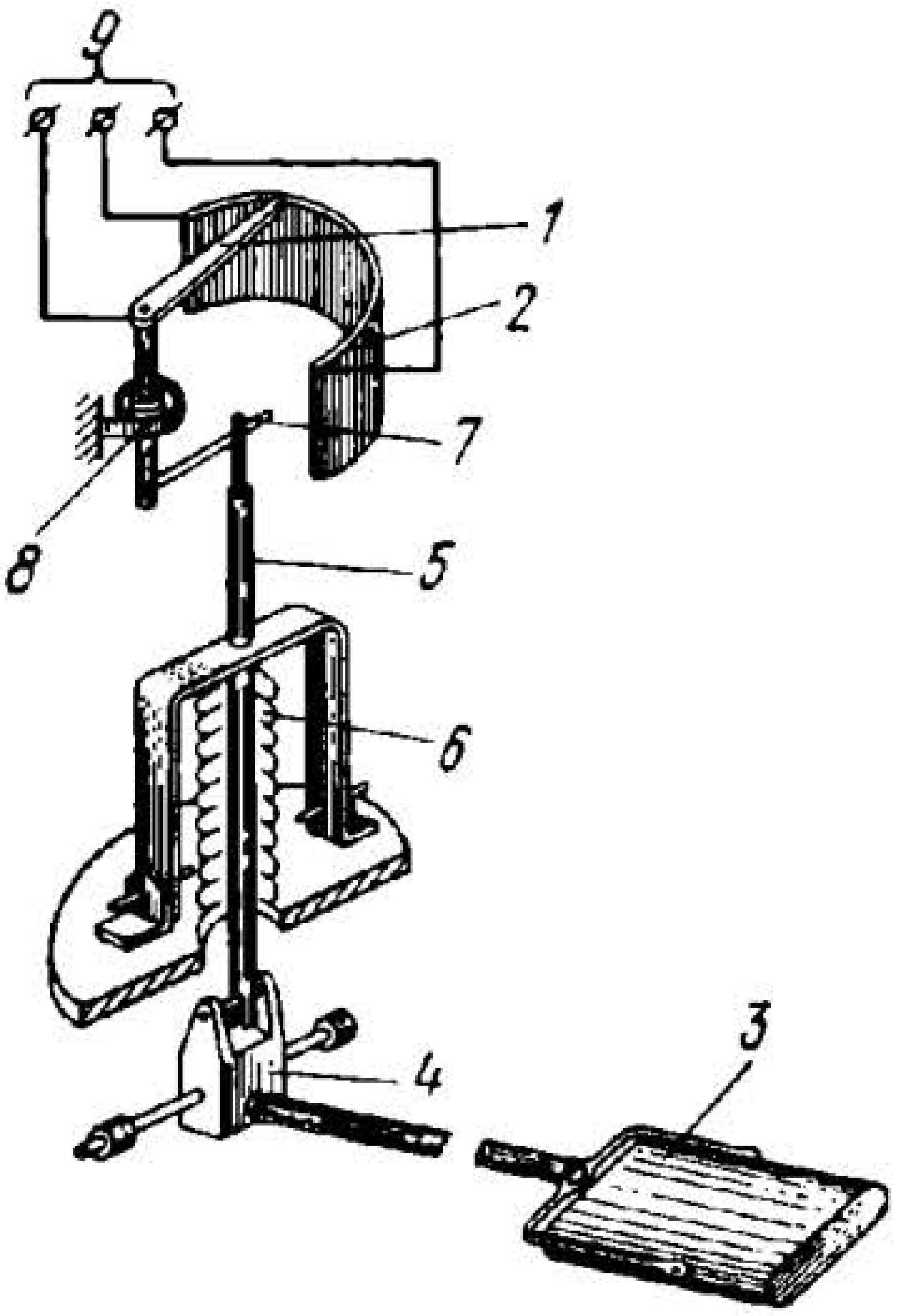
Deformed by the difference in pressure inside and outside, double aneroid capsule *1* turns shaft *4* through tie-rod *2* and crank *3*. Turned together with shaft *4* is segment gear *5*, meshing with pinion *6*. Pinion *6* is mounted on a shaft together with gears *7* and *8*, and hairspring *15* which eliminates backlash. Gear *7* meshes with pinion *9* on whose shaft hand *11* is mounted. Gear *8* meshes with gear *10* on whose hollow shaft hand *12* is mounted. Hand *11* rotates ten times faster than hand *12*. At a speed increase of 100 km/h, hand *11* makes one revolution and indicates a reading in tens of kilometres, while hand *12* makes 0.1 revolution and indicates a reading in hundreds of kilometres. Hands *11* and *12* indicate zero when fixed magnet *13* attracts iron rod *14*. When the aircraft reaches a speed exceeding a certain minimum value, rod *14* breaks away from magnet *13*, after which the instrument responds to all changes in speed. Flat spring *16*, whose end *a* bears against the centre of aneroid capsule *1*, provides for a uniformly graduated scale. Screws *17* adjust the action of spring *16*.

3938	LEVER MECHANISM OF A TWO-HAND ALTIMETER	LHP M



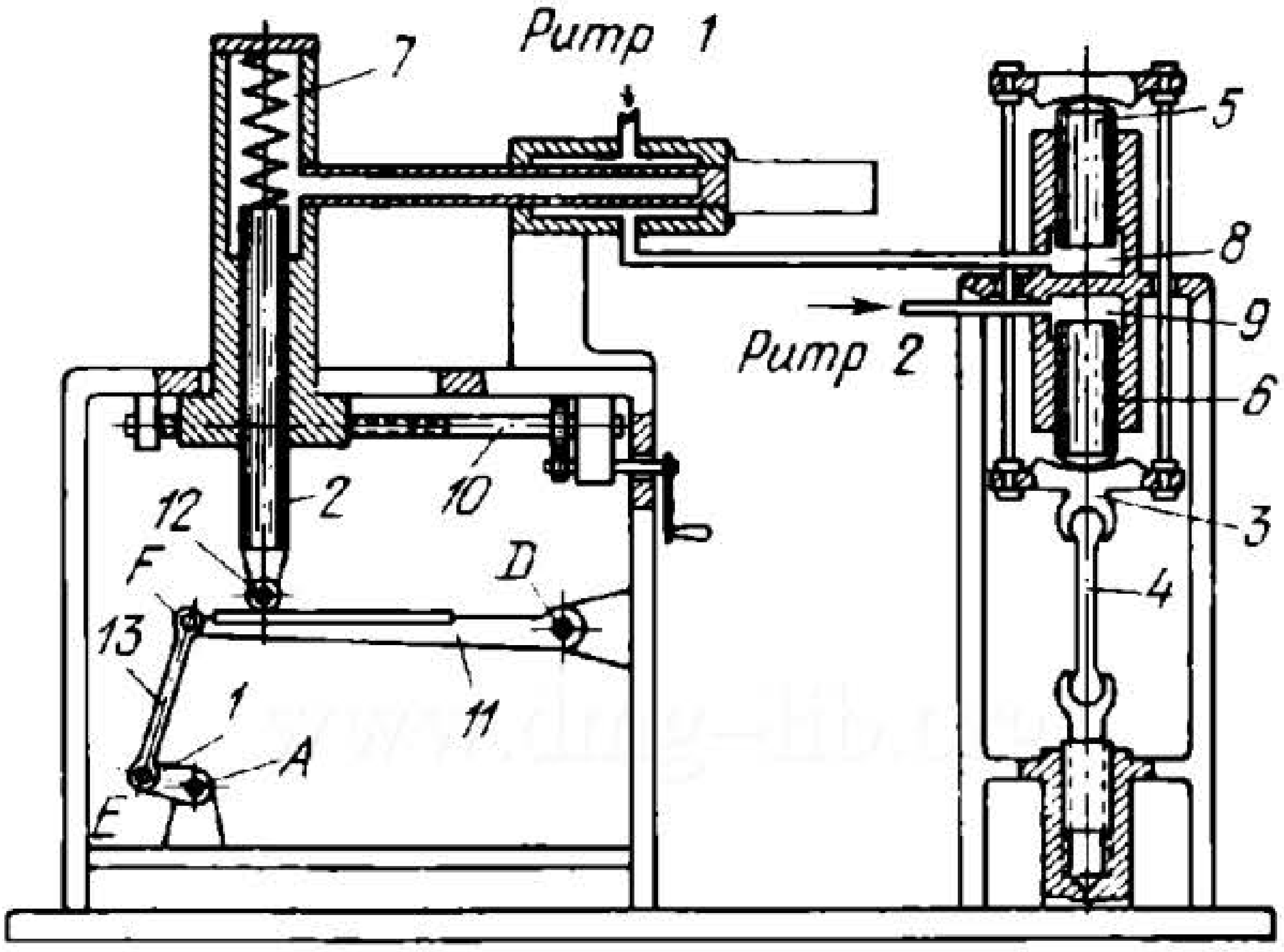
When the external pressure drops, aneroid capsule *1* expands and, by means of tie-rod *2*, turns shaft *3* with segment gear *4*. Segment gear *4* turns pinion *5* which is secured to large gear *6*, meshing with pinion *7*. Large hand *8* is rigidly mounted on the shaft of pinion *7*. Hand *8* makes one revolution per 1000 m altitude. Hand *9*, driven through a train of gears, *15*, *14*, *17* and *16*, with a gearing ratio of 10 : 1, makes one revolution per 10 000 m. A uniformly graduated scale is obtained by the provision of spring counterbalance *10* whose elasticity compensates for the nonlinear deformation of the capsule by the varying air density. The hands are set by knob *11* which turns plate *12* on which gears *14* and *17* are mounted. At the same time, the pinion of knob *11* turns scale *13*, indicating the barometric pressure.

3939	LEVER MECHANISM OF A GASOLINE GAUGE PICKUP	LHP M



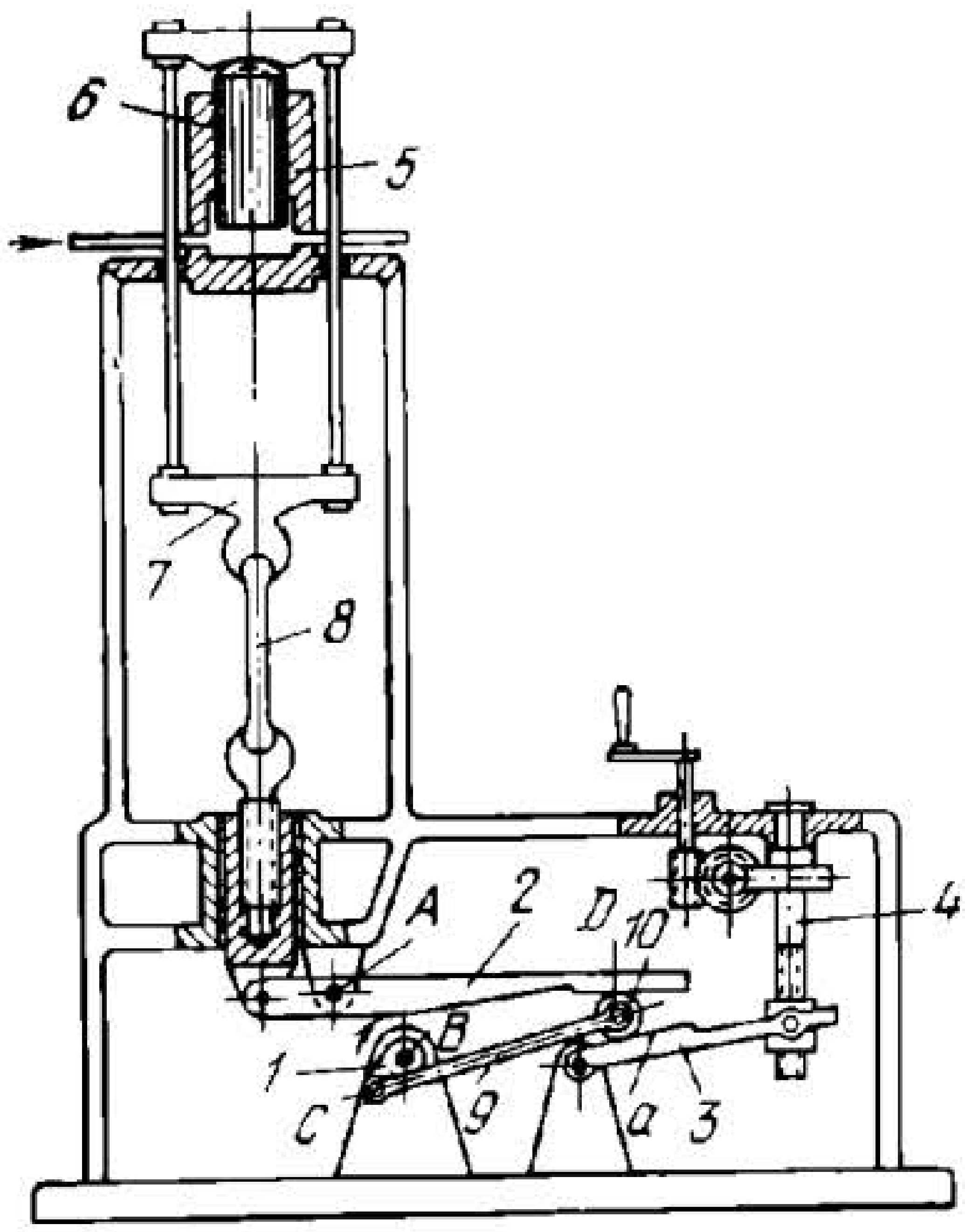
The motion of float *3* is transmitted to rocker arm *4* and lever *5* which passes through bellows *6* to ensure complete airtightness of the outlet. Spiral spring *8* tends to turn lever *1* to its extreme position in which arm 7 contacts lever *5*. The fuel level in the tank is registered by lever *1* which slides along the coil of potentiometer *2*. Leads *9* of the potentiometer are connected to an electric instrument which indicates the gasoline level in the tank.

3940	LEVER MECHANISM OF A TENSILE AND COMPRESSION TESTING MACHINE	LHP M



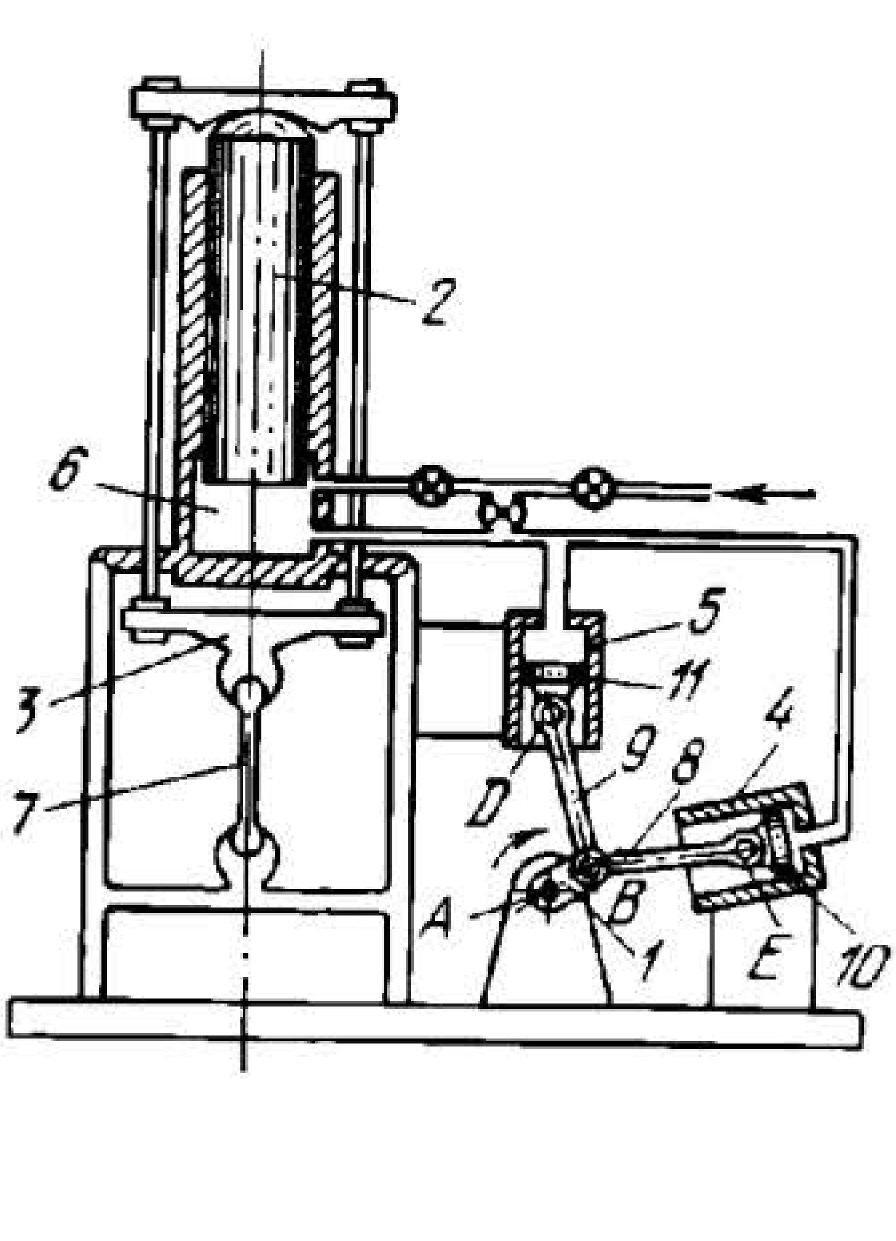
Upper grip *3* for test piece *4* comprises a frame joining pistons *5* and *6*. Cylinder *8* is connected to one pump, cylinder *9* to another. Pulsator 7, serving to apply a variable load, is connected by a pipeline to cylinder *8*. When crank *1* rotates about fixed axis *A*, link *13*, connected by turning pairs *E* and *F* to crank *1* and to rocker arm *11*, oscillates the rocker arm about fixed axis *D*. This oscillation is transmitted through roller *12* to plunger *2* of pulsator *7*. The pulsator is set up manually by means of shaft *10*.

3941	LEVER MECHANISM OF A TENSILE TESTING MACHINE	LHP M



When crank 1 rotates about fixed axis B, link 9, connected by turning pairs C and D to crank 1 and to roller 10, oscillates and the roller is rolled along surface a of link 3. This oscillates lever 2 about fixed axis A, applying a variable load to test piece 8. Guide surface a, inclined with respect to lever 2, can be turned by special device 4 to regulate the applied load. In testing with a static load it is applied by a pump delivering fluid to cylinder 5. Plunger 6 transmits the load to upper grip 7.

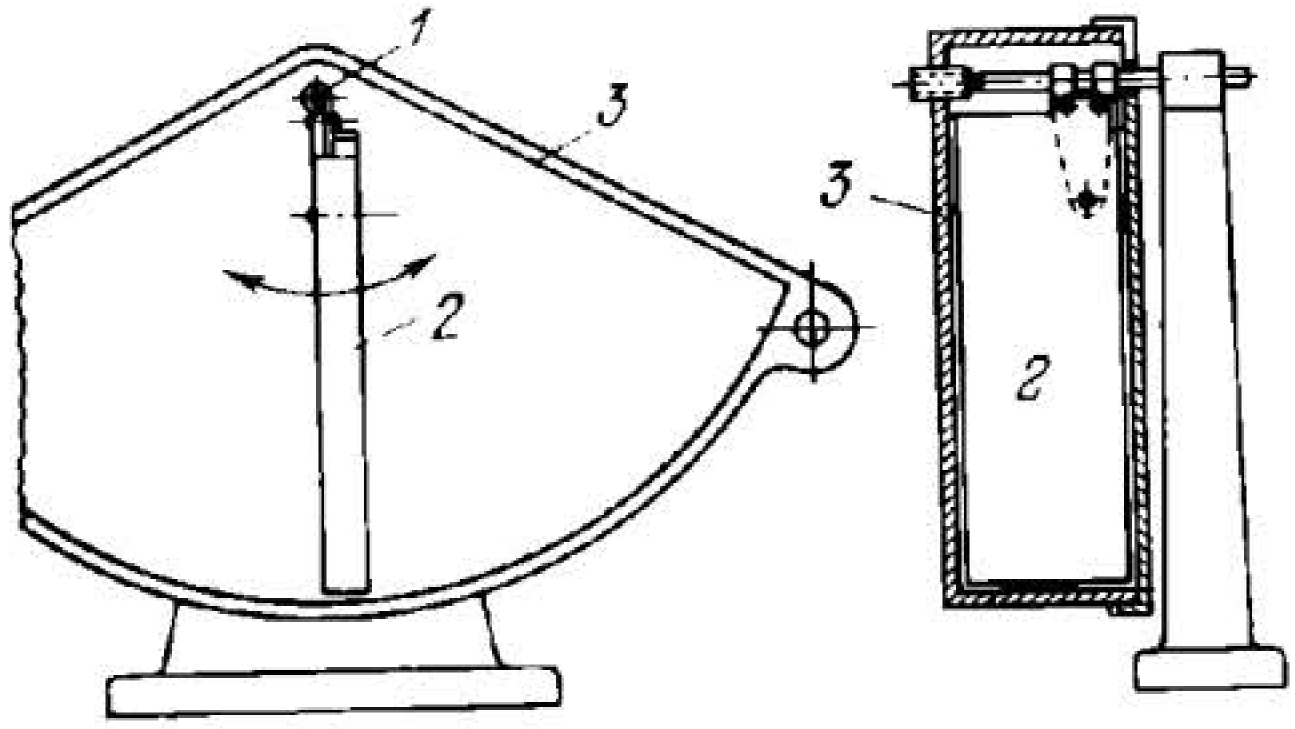
3942	LEVER MECHANISM OF A TENSILE TESTING MACHINE	LHP M



Plunger 2, transmitting motion and the load to upper grip 3, is actuated by fluid delivered by an installation which is not shown. The device for applying a variable load consists of two slider-crank mechanisms with common crank 1, rotating about fixed axis A, and connecting rods 8 and 9, connected by turning pairs B to crank 1 and by turning pairs E and D to pistons 10 and 11. Pistons 10 and 11 reciprocate in cylinders 4 and 5. When crank 1 rotates, fluid is delivered alternately from cylinders 4 and 5 into cylinder 6, thereby applying a variable load to test piece 7.

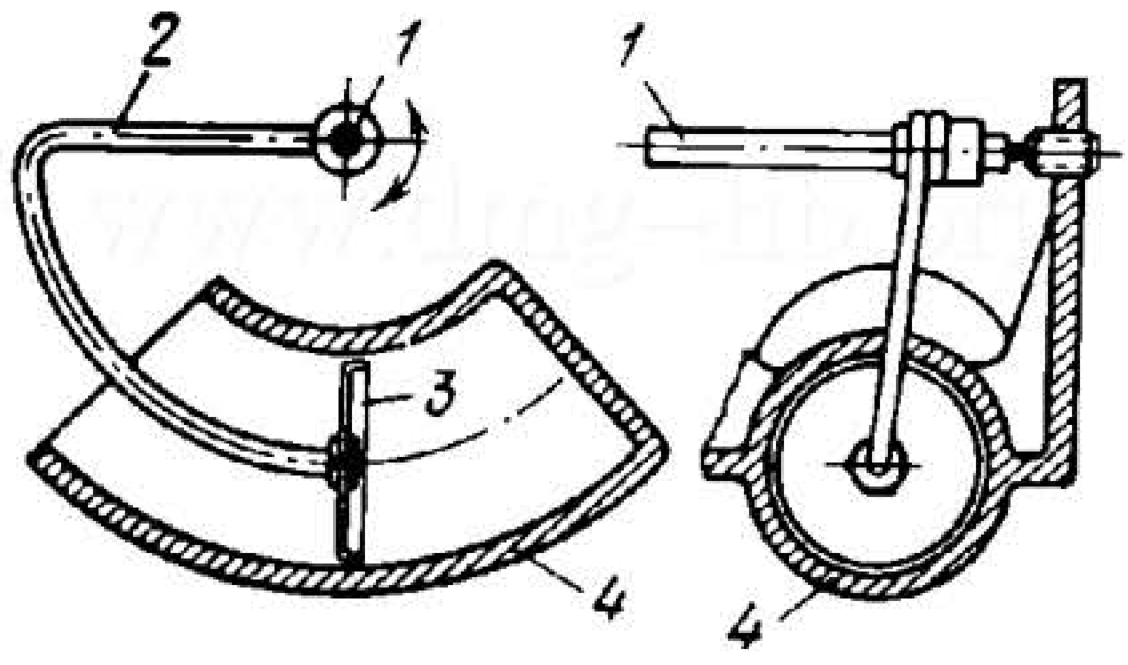
6. DAMPER AND CATARACT MECHANISMS
(3943 through 3947)

3943	LEVER MECHANISM OF A VANE-TYPE DAMPER	LHP DC



Oscillations of shaft *1* are damped by means of vane *2*, attached to the shaft and swinging in chamber *3* filled with a viscous liquid.

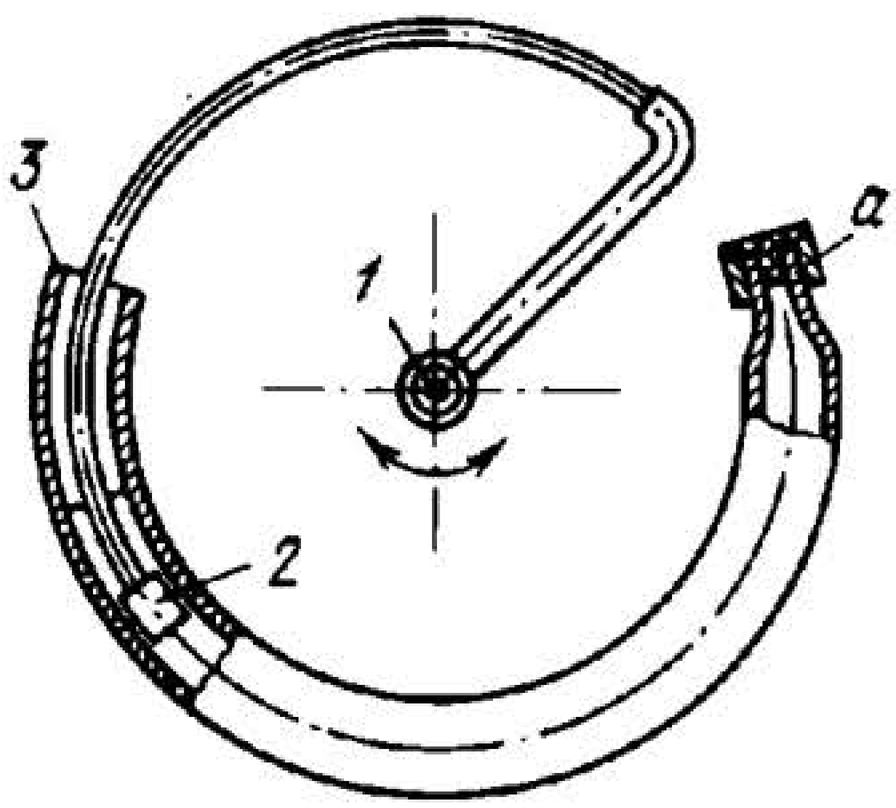
3944	LEVER MECHANISM OF A PISTON-TYPE DAMPER	LHP DC



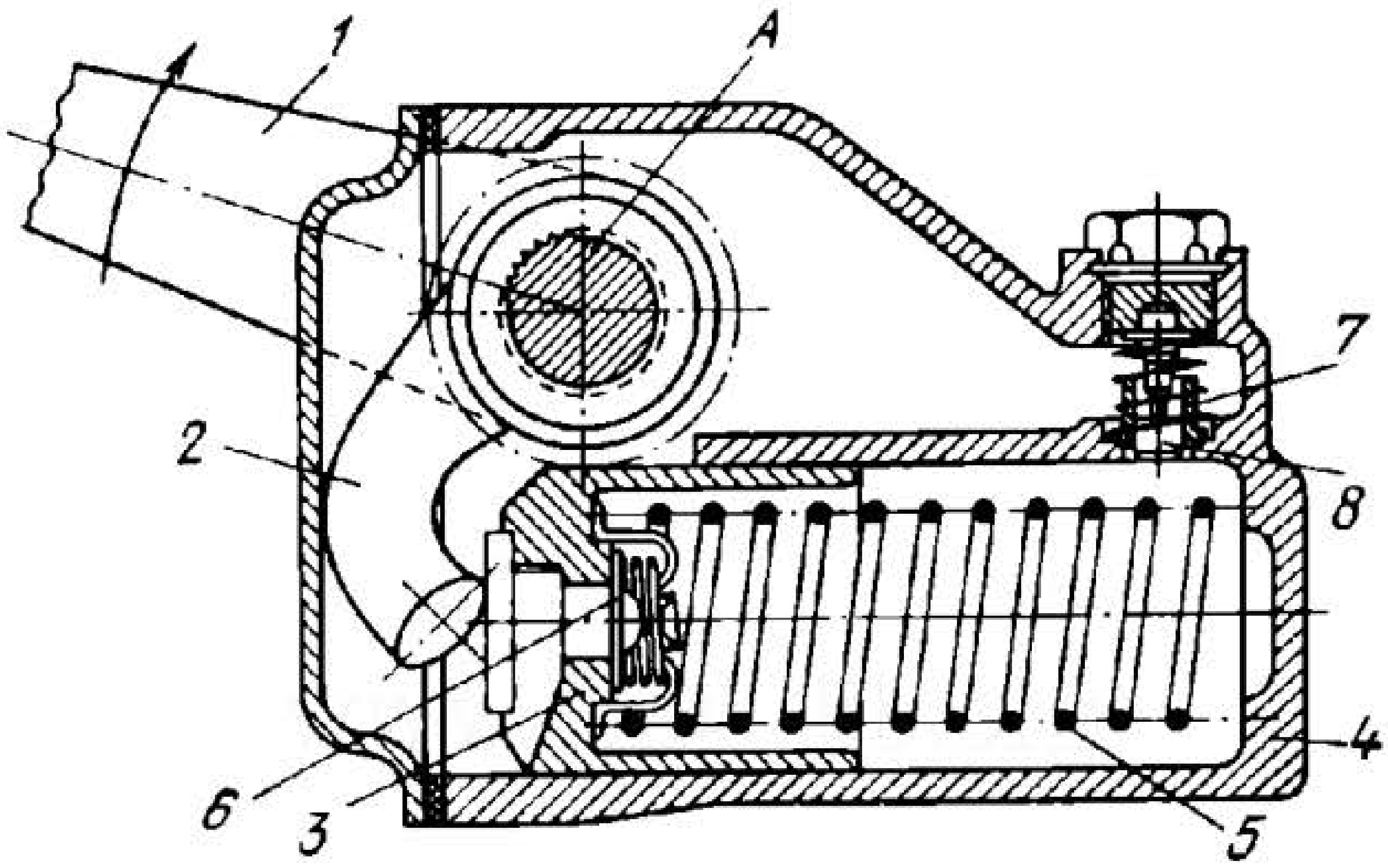
Oscillations of shaft *1* are damped by means of piston *3*, attached by curved rod *2* to the shaft and swinging in closed chamber *4* filled with a viscous liquid.

3945	LEVER MECHANISM OF A PISTON-TYPE DAMPER FOR A POINTER INSTRUMENT	LHP DC

Oscillations of shaft *1*, on which the hand is mounted, are damped by the motion of piston *2* in annular cylinder *3* filled with a viscous liquid. End *a* of the annular tube is of smaller diameter to increase the degree of damping near the extreme end position of the oscillating motion.

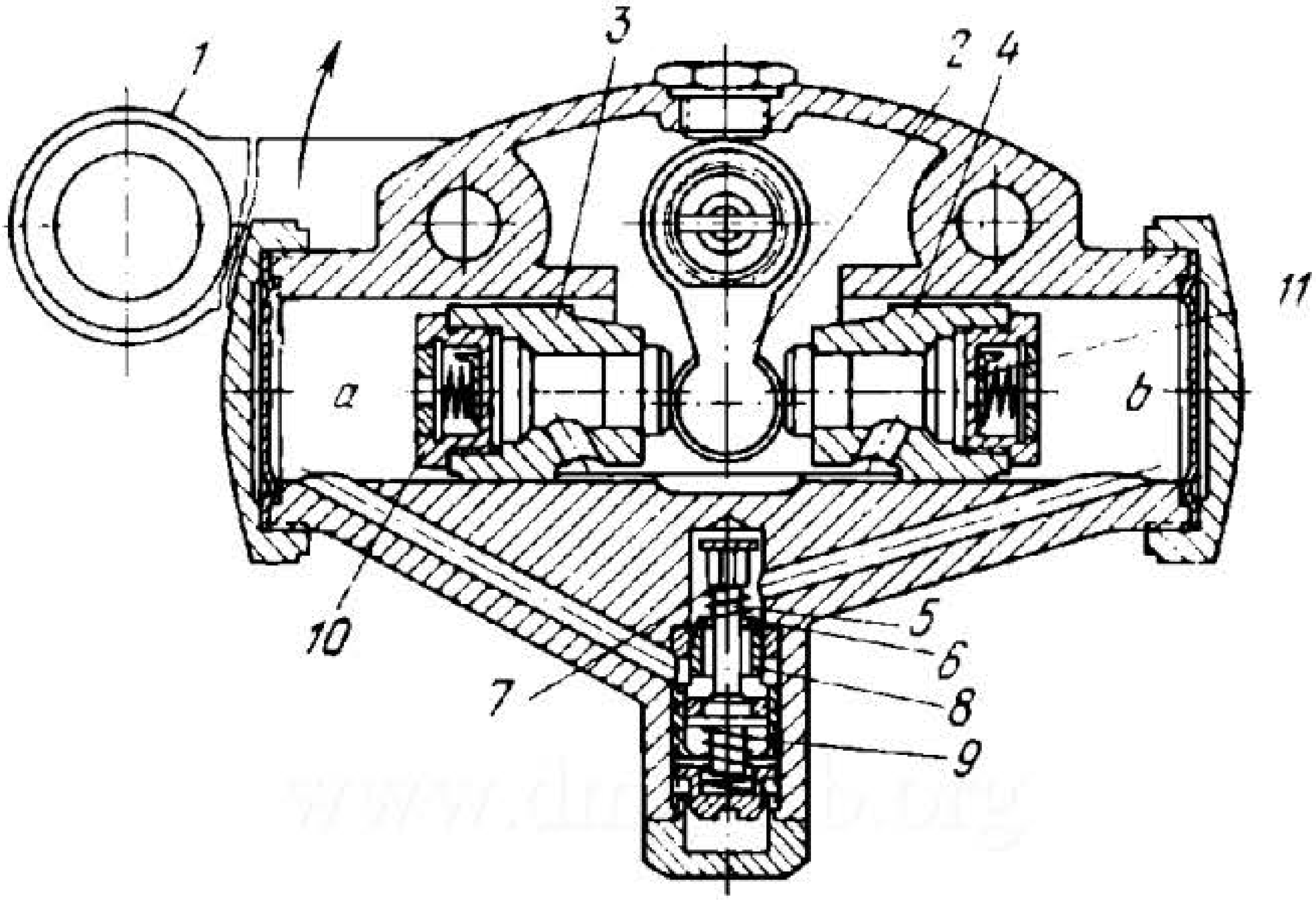


3946	LEVER MECHANISM OF A HYDRAULIC SHOCK ABSORBER FOR AN AUTOMOBILE SUSPENSION	LHP DC



When lever *1* turns clockwise, lever *2* and shaft *A* turn in the same direction, the end of lever *2* being withdrawn from piston *3*. This piston is moved out of cylinder *4* by spring *5* and the cylinder is filled with fluid through opened check valve *6*. When lever *1* turns in the opposite direction, lever *2* and shaft *A* turn with it. At this, the end of lever *2* pushes piston *3* to the right, compressing spring *5*. Check valve *6* closes and the fluid can escape into the housing only through the passage provided by the flat on pin *8* without lifting valve 7. Only a small amount of fluid can flow out of cylinder *4*, thereby decelerating the motion of the piston. Valve 7 opens only upon a drastic increase in the load transmitted to lever *1*.

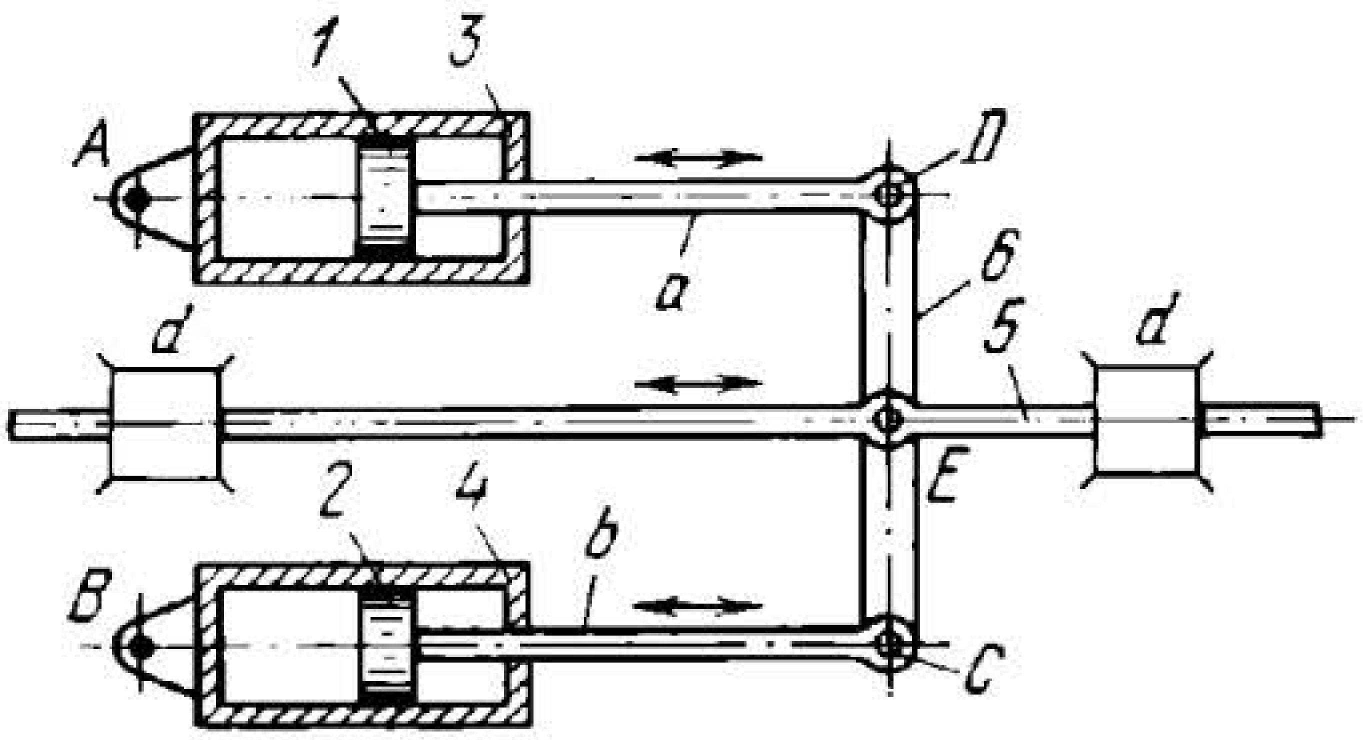
3947	LEVER MECHANISM OF A DOUBLE HYDRAULIC SHOCK ABSORBER FOR AN AUTOMOBILE SUSPENSION	LHP DC



When lever *1* turns clockwise, cam *2*, rigidly secured to lever *1*, turns in the same direction and plungers *3* and *4* move to the left. At this, fluid flows from chamber *a* to chamber *b* through the clearance between pin *5* and the ring of valve *6* which is loaded by spring 7. When lever *1* turns counterclockwise, plungers *3* and *4* move to the right and the fluid flows from chamber *b* to chamber *a* along the same path. If lever *1* is turned suddenly clockwise, the plungers move rapidly to the left, developing high pressure in chamber *a*. Then, as the fluid flows from chamber *a* to chamber *b*, it opens ring valve *6* and compresses spring 7. Upon reversal of the plungers, fluid flows from chamber *b* to chamber *a*, opening conical valve *8* and compressing stronger spring *9*. Fluid from in between the plungers can flow into chambers *a* and *b* through check valves *10* and *11*, loaded by weak springs.

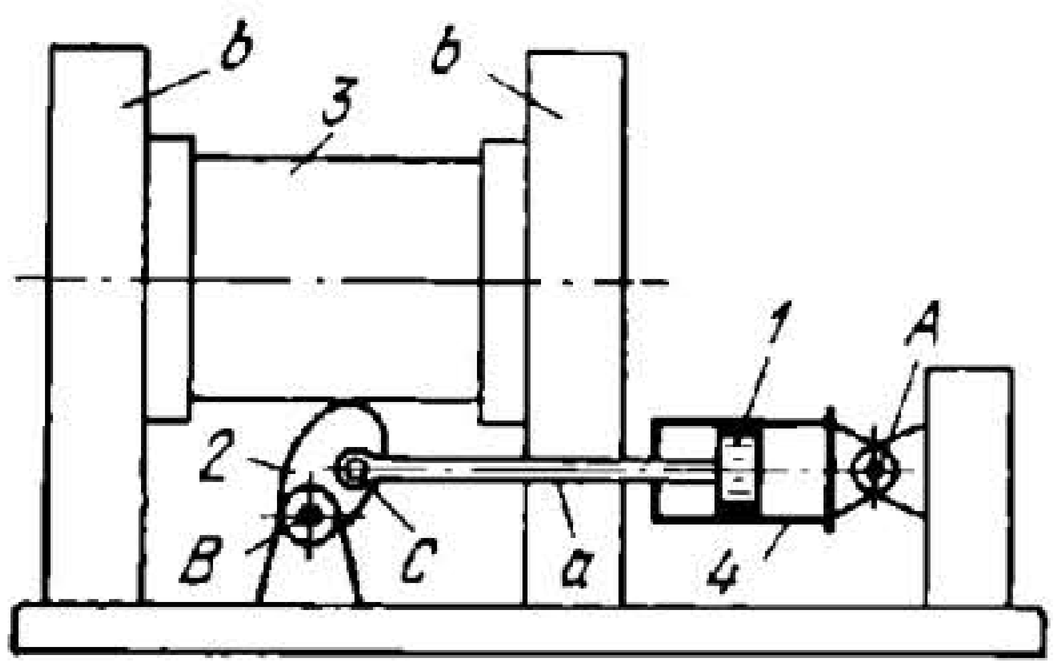
7. DRIVE MECHANISMS (3948 through 3953)

3948	LEVER-TYPE ADDING MECHANISM WITH TWO CYLINDERS	LHP Dr



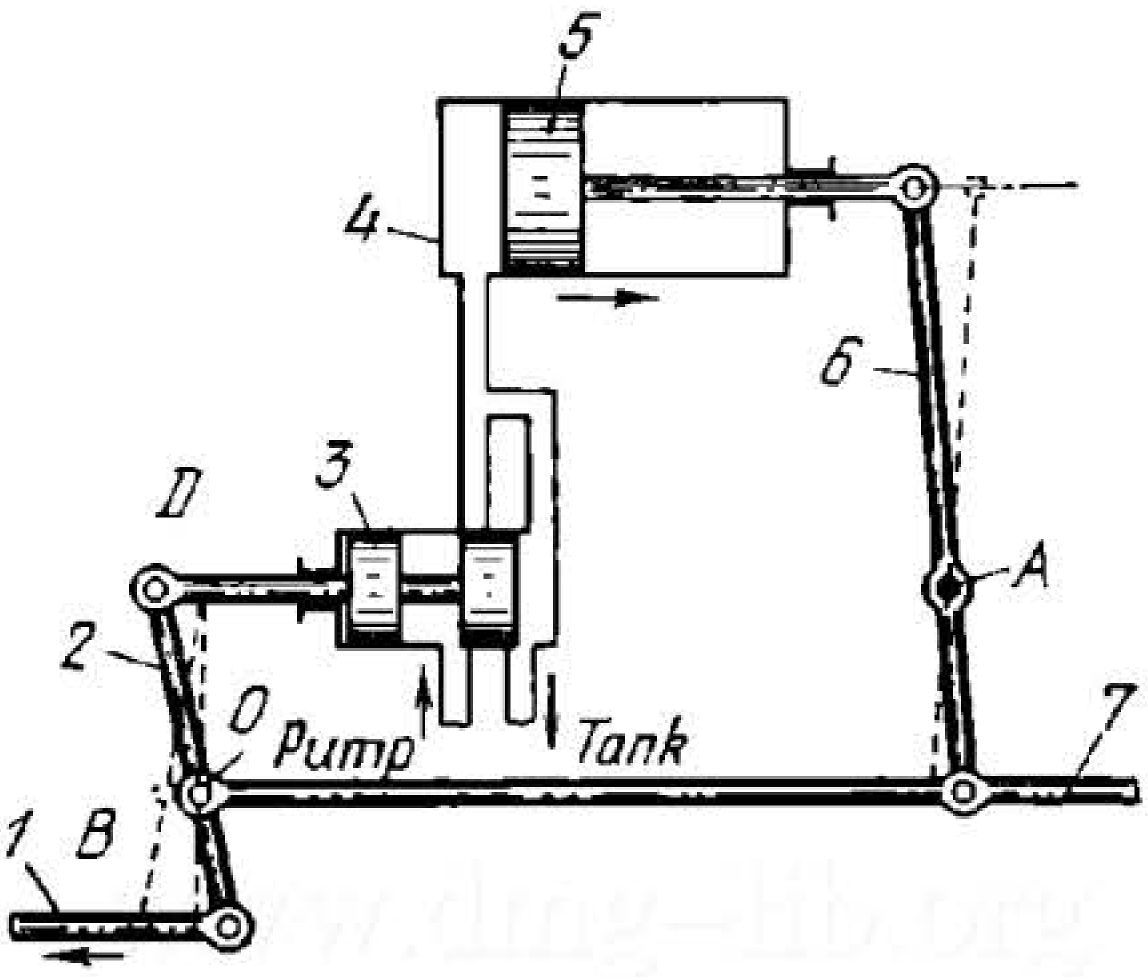
Piston *1* reciprocates in cylinder *3* which turns about fixed axis *A*. Piston *2* reciprocates in cylinder *4* which turns about fixed axis *B*. Piston rods *a* and *b* of pistons *1* and *2* are connected by turning pairs *D* and *C* to crosspiece *6* which, in turn, is connected by turning pair *E* to link *5*. Link *5* reciprocates in fixed guides *d*. Upon independent motion of pistons *1* and *2*, actuated by fluid delivered to cylinders *3* and *4*, link *5* reciprocates. The displacement of link *5* is proportional to the sum of the displacements of pistons *1* and *2*.

3949	LEVER-CAM MECHANISM WITH A HYDRAULIC DRIVE	LHP Dr



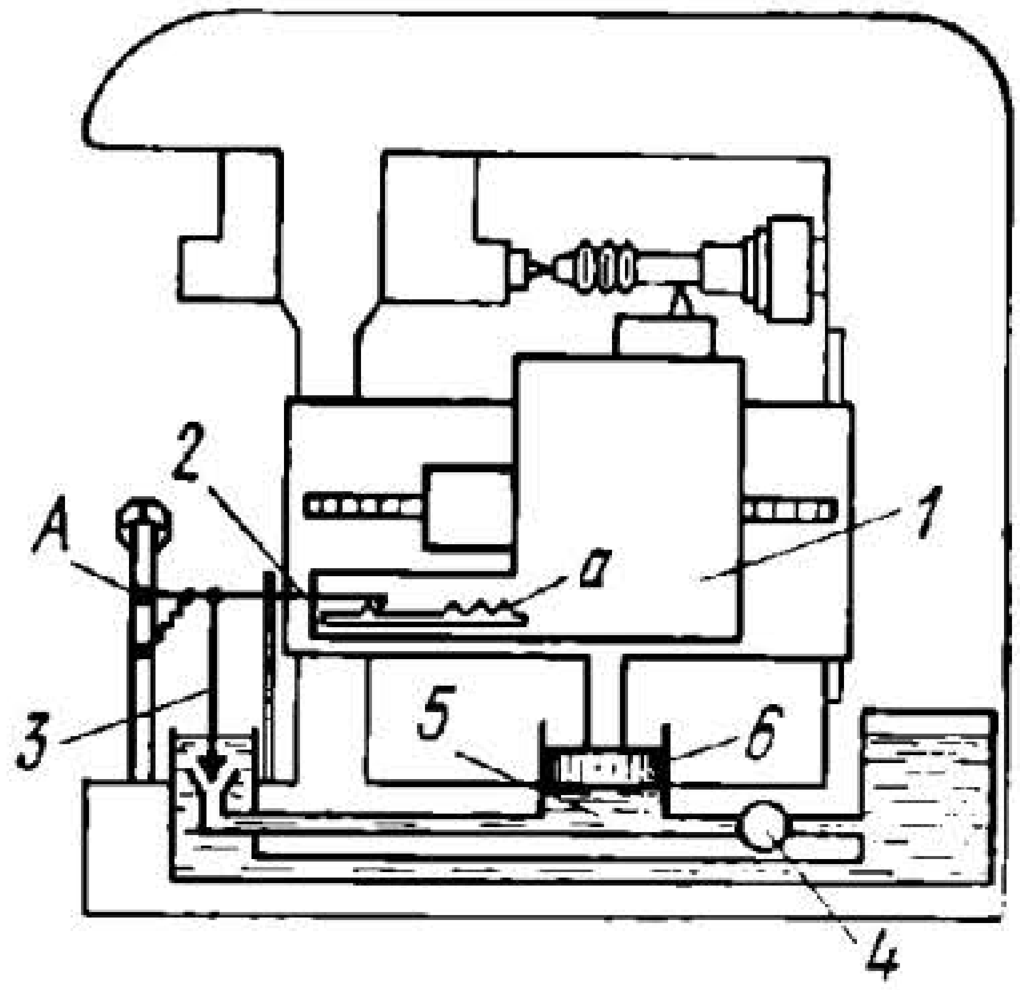
Piston *1* reciprocates in cylinder *4* which turns about fixed axis *A*. Rod *a* of piston *1* is connected by turning pair *C* to cam *2* which turns about fixed axis *B*. As piston *1* is moved by fluid delivered to cylinder *4*, cam *2* is turned and it reciprocates link *3* in fixed guides *b*. Link *3* is held in contact with cam *2* by its weight.

LEVER MECHANISM OF A FOLLOW-UP CONTROL SYSTEM



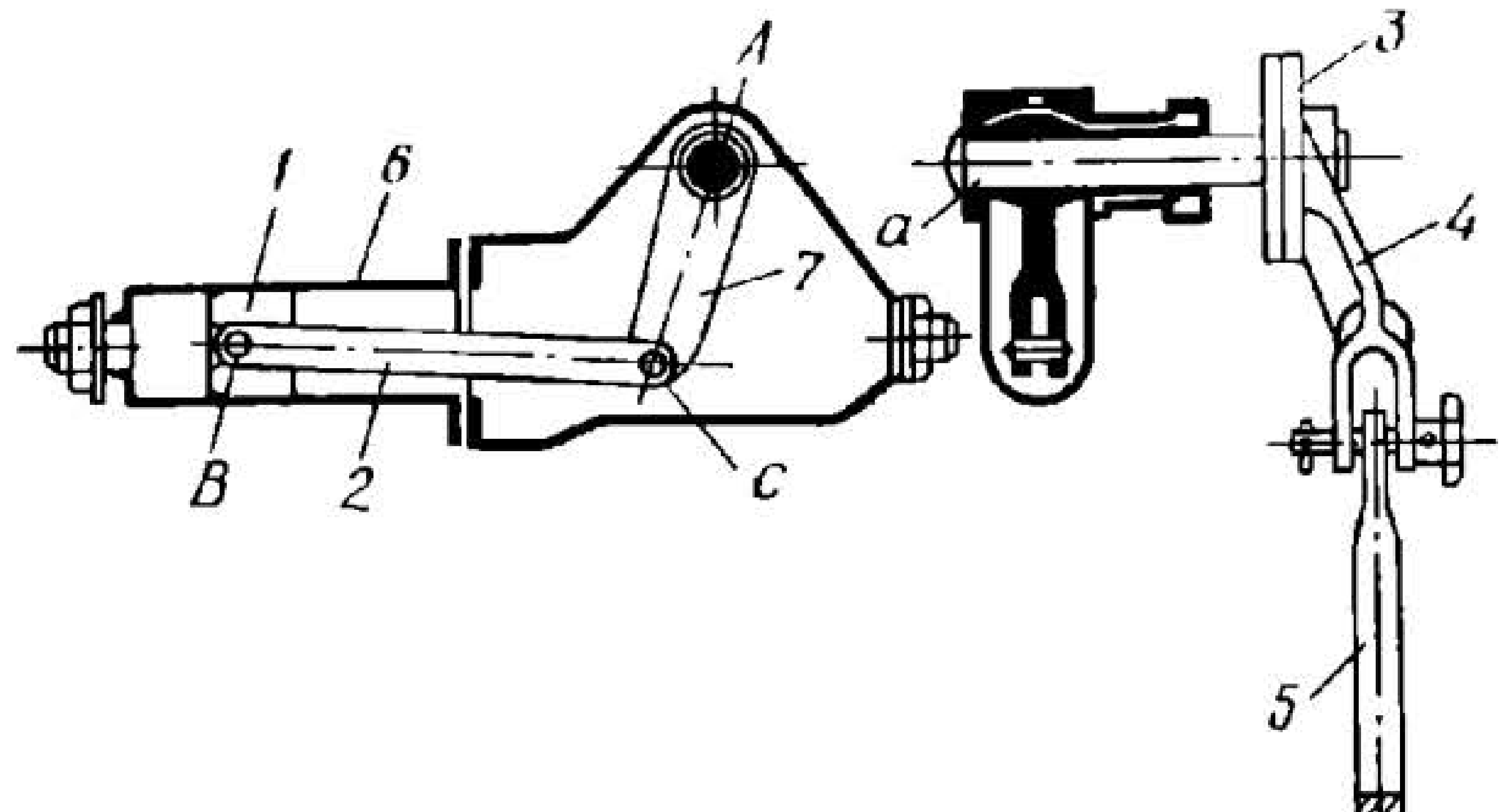
When tie-rod 1, linked to the control lever, moves to the left, lever 2 turns about point O, shifting valve spool 3 to the right. At this, servomotor 4 is blocked off from the drain and is connected to the pressure main. The fluid moves piston 5 to the right. Lever 6, turning about fixed axis A, actuates the mechanism being controlled through tie-rod 7. If tie-rod 1 continues to move to the left, lever 2 turns about point D. If tie-rod 1 is stopped, lever 2 turns about point B, spool 3 is shifted to the left, disconnecting servomotor 4 from the pressure main and connecting it to the tank. When tie-rod 1 is returned to its initial position, valve spool 3 and servomotor 4 are also returned to the initial position.

3951	LEVER MECHANISM OF A TRACER FOLLOW-UP DEVICE	LHP Dr



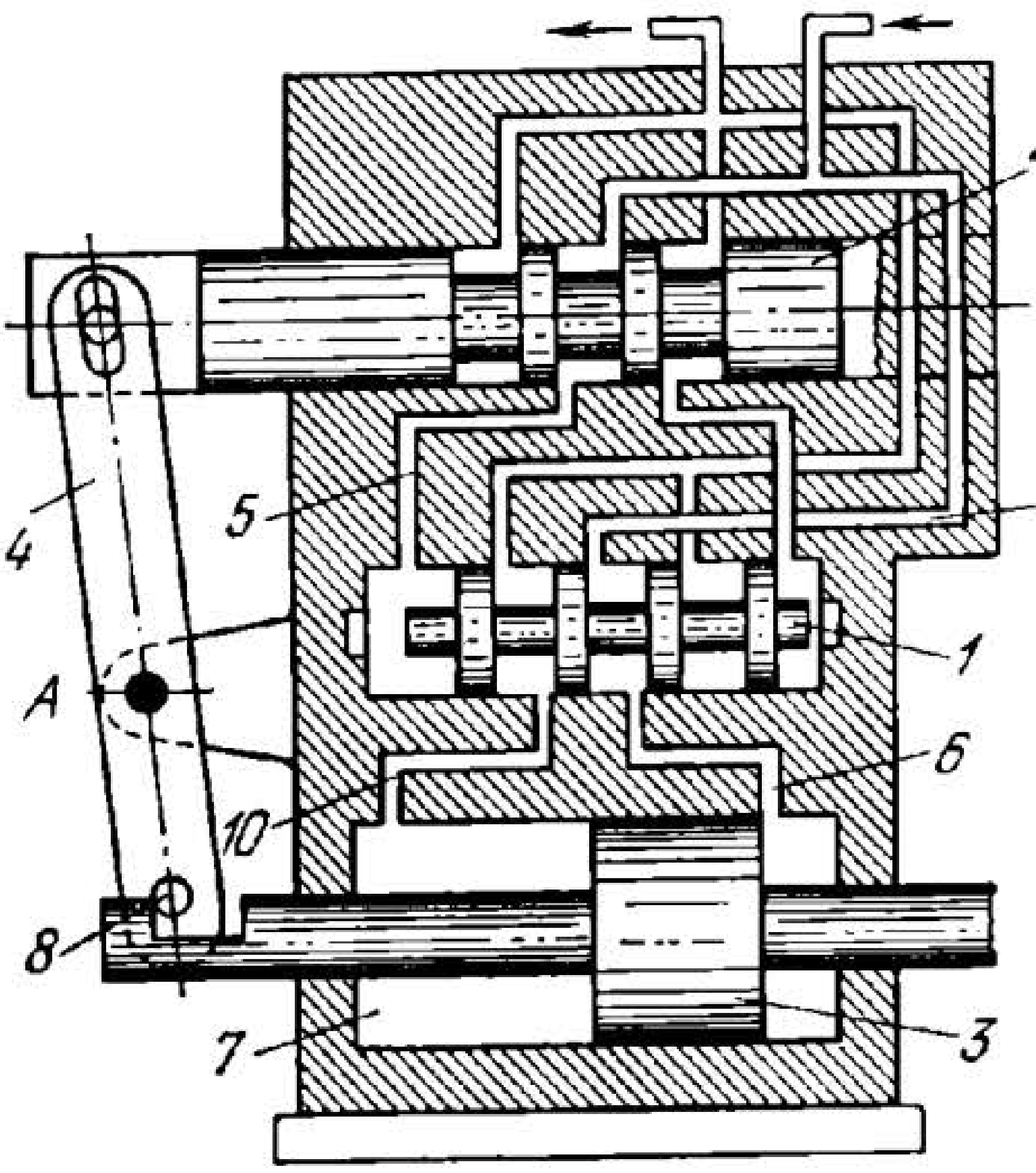
Upon uniform horizontal travel of slide *1*, former bar *a*, mounted on the slide, actuates the end of lever *2*. Lever *2* turns about fixed axis *A* and is linked to valve *3*. Pump *4* delivers fluid to power cylinder *5*. When valve member *3* is raised, pressure in cylinder *5* drops and piston *6* moves downward with slide *1*. When valve member *3* is lowered, slide *1* moves upward. Thus, piston *6* follows up the motion of valve member *3* and the cutting tool describes a curve which is similar to, but a mirror image of, the profile of the former bar.

3952	LEVER MECHANISM FOR TRANSMISSION FROM A SERVOMOTOR PISTON TO A VALVE	LHP Dr



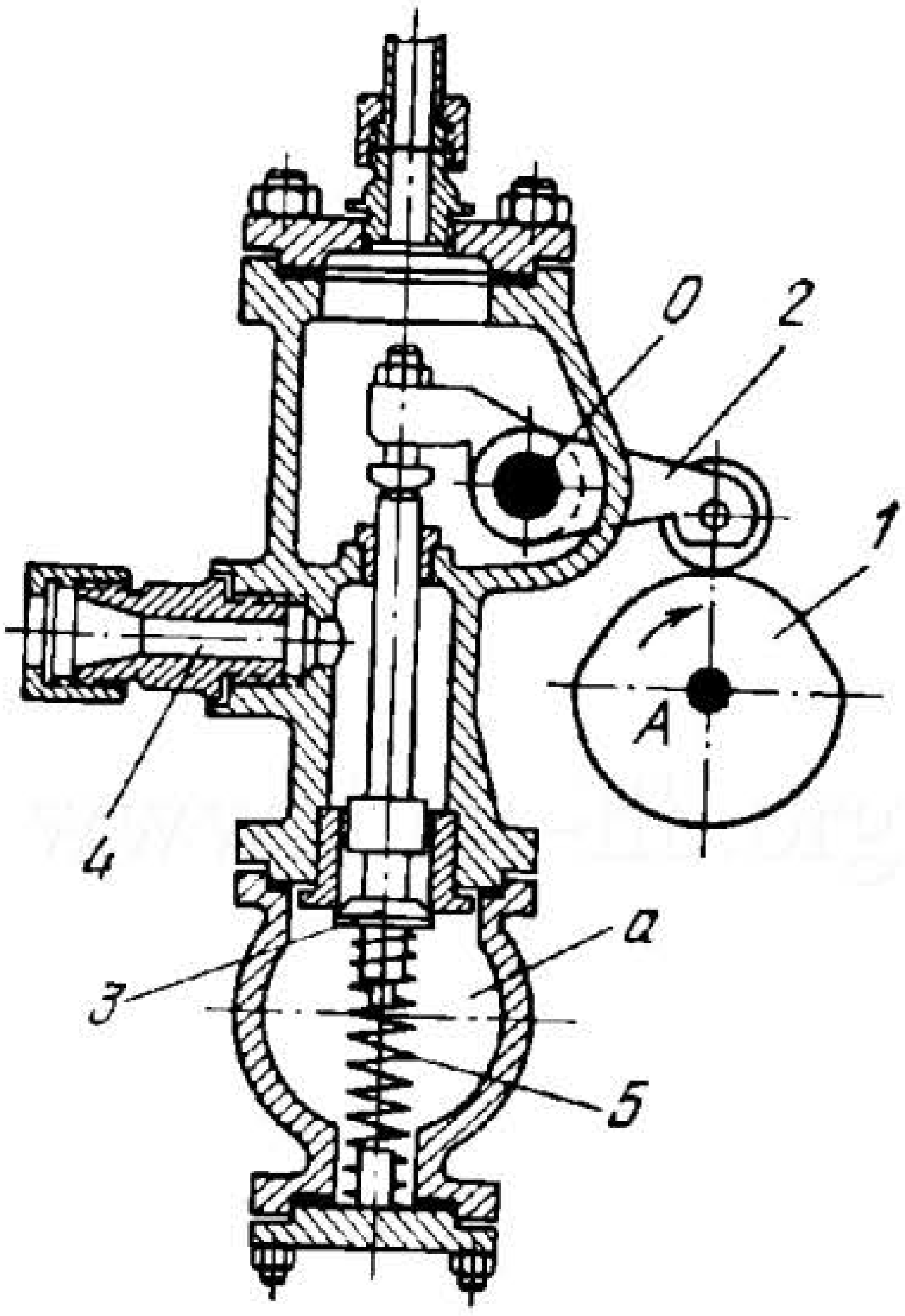
Piston *1* of the servomotor reciprocates in cylinder *6*. Connecting rod *2* is connected by turning pairs *B* and *C* to piston *1* and to crank *7* which turns about fixed axis *A*. Motion of piston *1* turns crank *7* and shaft *a*, rigidly secured to the crank. Mounted outside on shaft *a* is flange *3* to which link *4* is secured. The fork-shaped end of link *4* is hinged to tie-rod *5* which is connected to the stem of the valve being controlled.

3953	LEVER MECHANISM OF A SUPERFINISHING HEAD DRIVE	LHP Dr



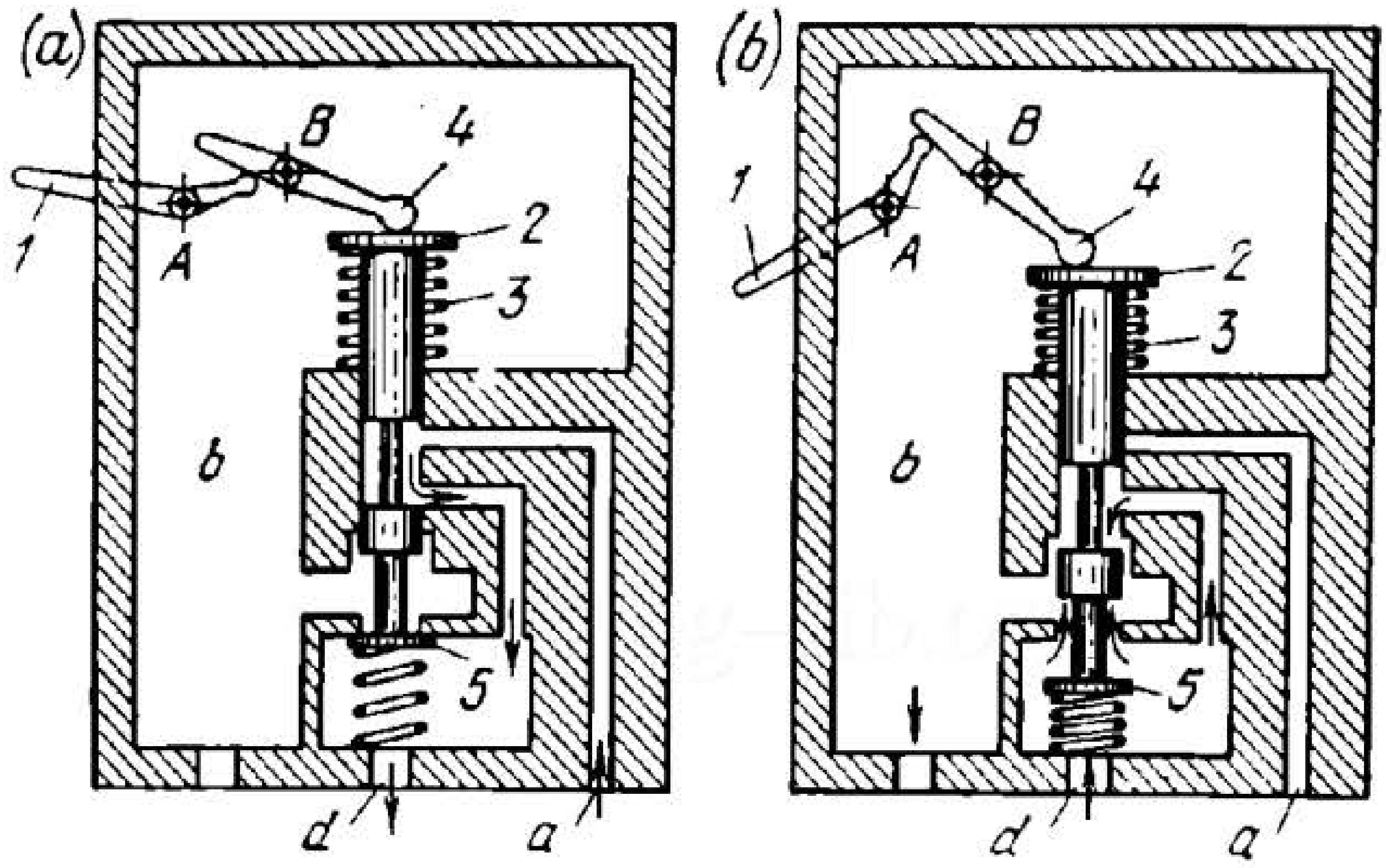
When the hydraulic motor is switched on, fluid under pressure is delivered to spools *1* and *2*. A part of the fluid, passing through a groove of pilot spool *2* and passage *5*, is delivered to the left end of main spool *1*, holding it in the right-hand position. The main stream of fluid passes through another groove of spool *2* and passage *6* to the right end of motor cylinder *7*, moving piston *3* to the left. At this, the piston rod pushes pin *8*, turning lever *4* about fixed axis *A* and shifting pilot spool *2* to the right. At this, fluid under pressure is delivered through passage *9* to the right end of spool *1*. From the left end fluid passes through passage *5* to the drain pipeline. In the extreme left-hand position of spool *1*, fluid passes through passage *10* to the left end of cylinder *7*; piston *3* moves to the right and fluid from the right end of the cylinder drains to the tank through passage *6* and a groove of spool *1*.

3954	LEVER-CAM MECHANISM OF A HYDRAULIC VALVE	LHP Va



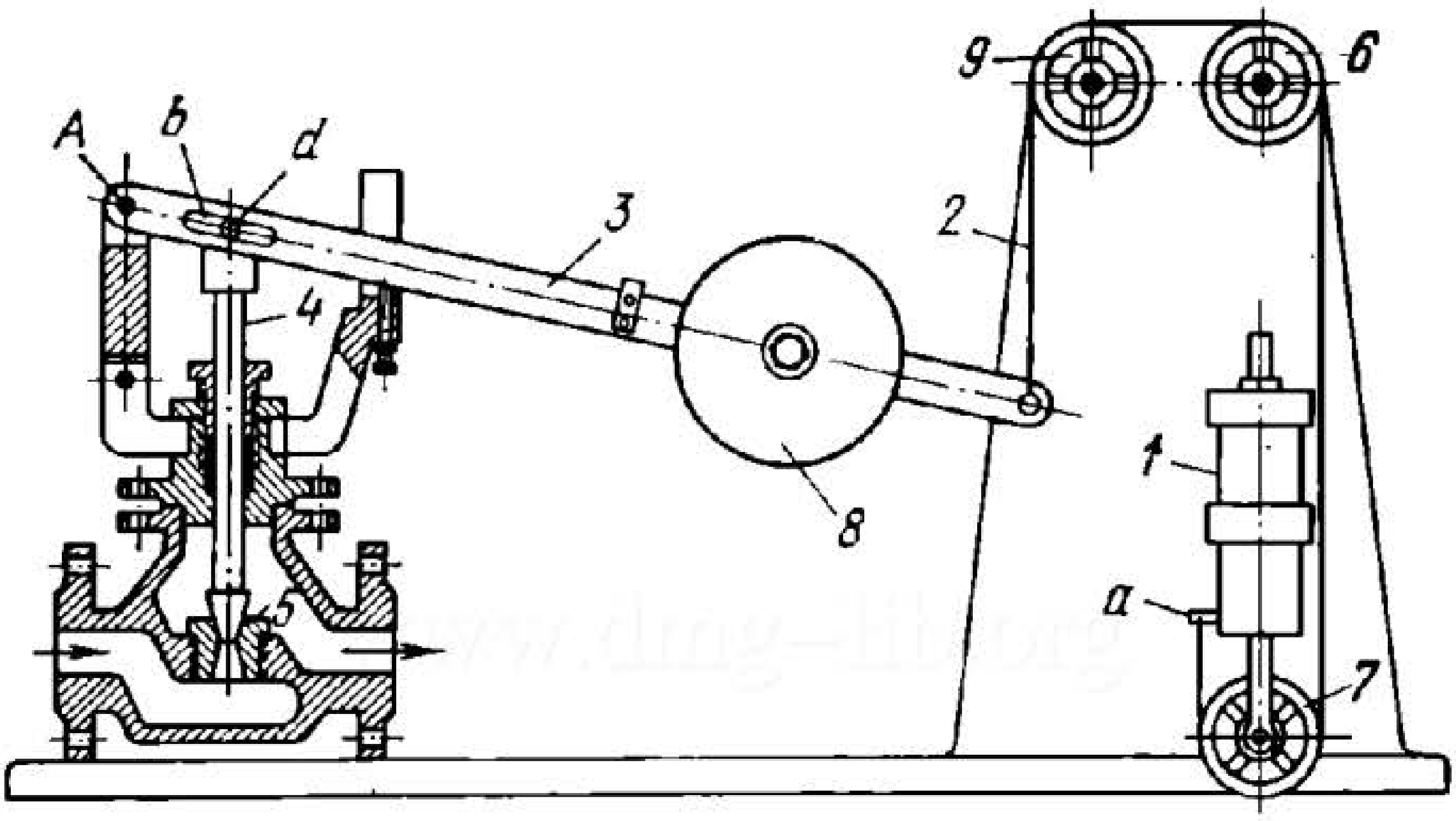
When cam *1* rotates about fixed axis *A*, lever *2*, turning about fixed axis *O*, depresses the stem of valve member *3*. Fluid delivered to chamber *a* is discharged through port *4*. When the roller of lever *2* runs off the lobe of cam *1*, valve member *3* is closed by the action of spring *5*.

3955	LEVER MECHANISM OF A SHUTOFF VALVE	LHP Va



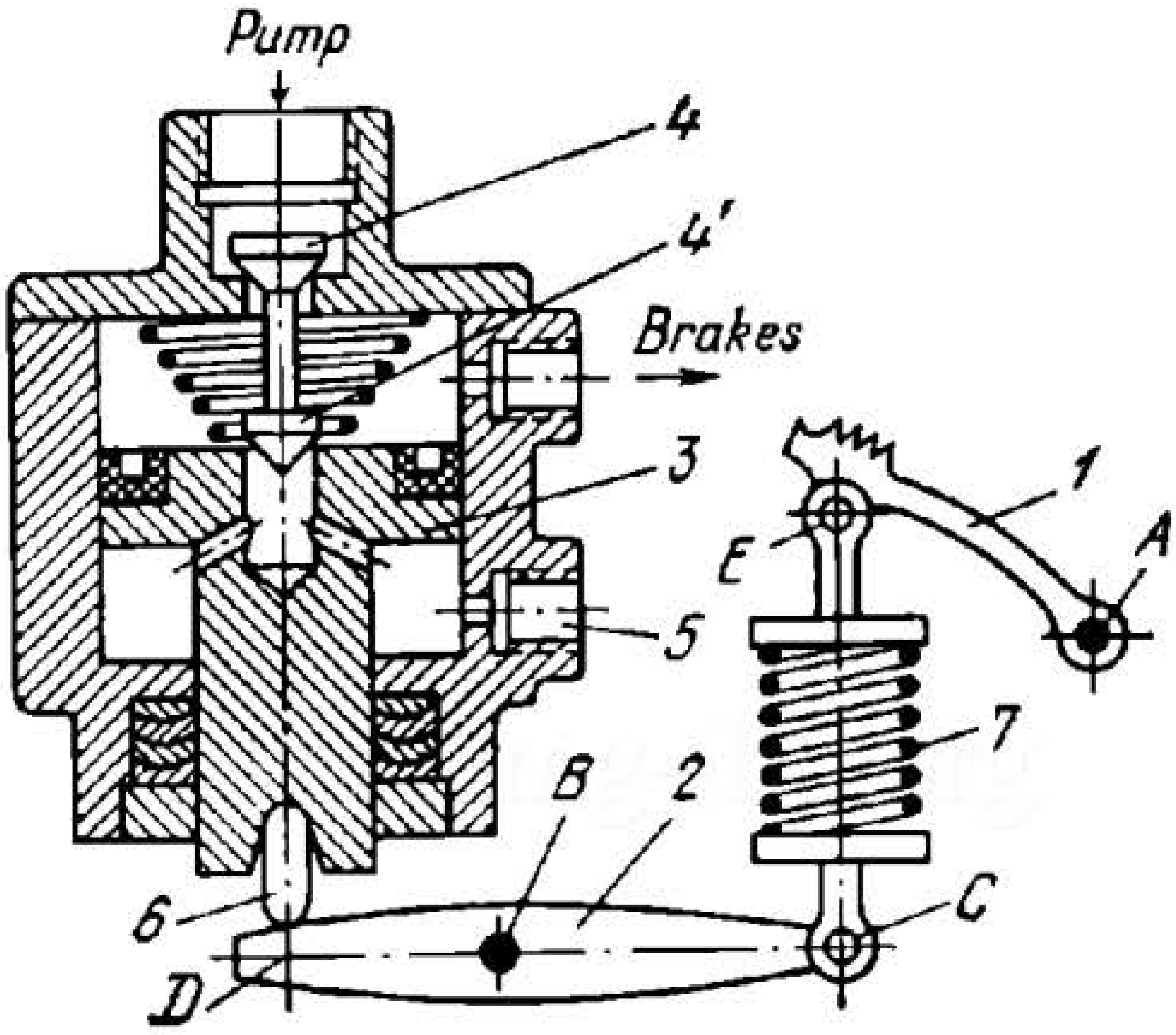
When pedal *1*, turning about fixed axis *A* (see Fig. *a*), is released, valve member *2* is pressed by spring *3* against lever *4*, which turns about fixed axis *B*. At this, passage *a*, through which fluid is delivered, is connected to port *d*. Port *d* is connected to the working end of the power cylinder. When pedal *1* is depressed (see Fig. *b*), lever *4* depresses valve member *2*, compressing spring *3*. This blocks off passage *a* and port *d* is connected to chamber *b* which leads to the drain pipe. At the same time, plate valve member *5* is opened.

3956	LEVER MECHANISM OF A HYDRAULIC VALVE	LHP Va



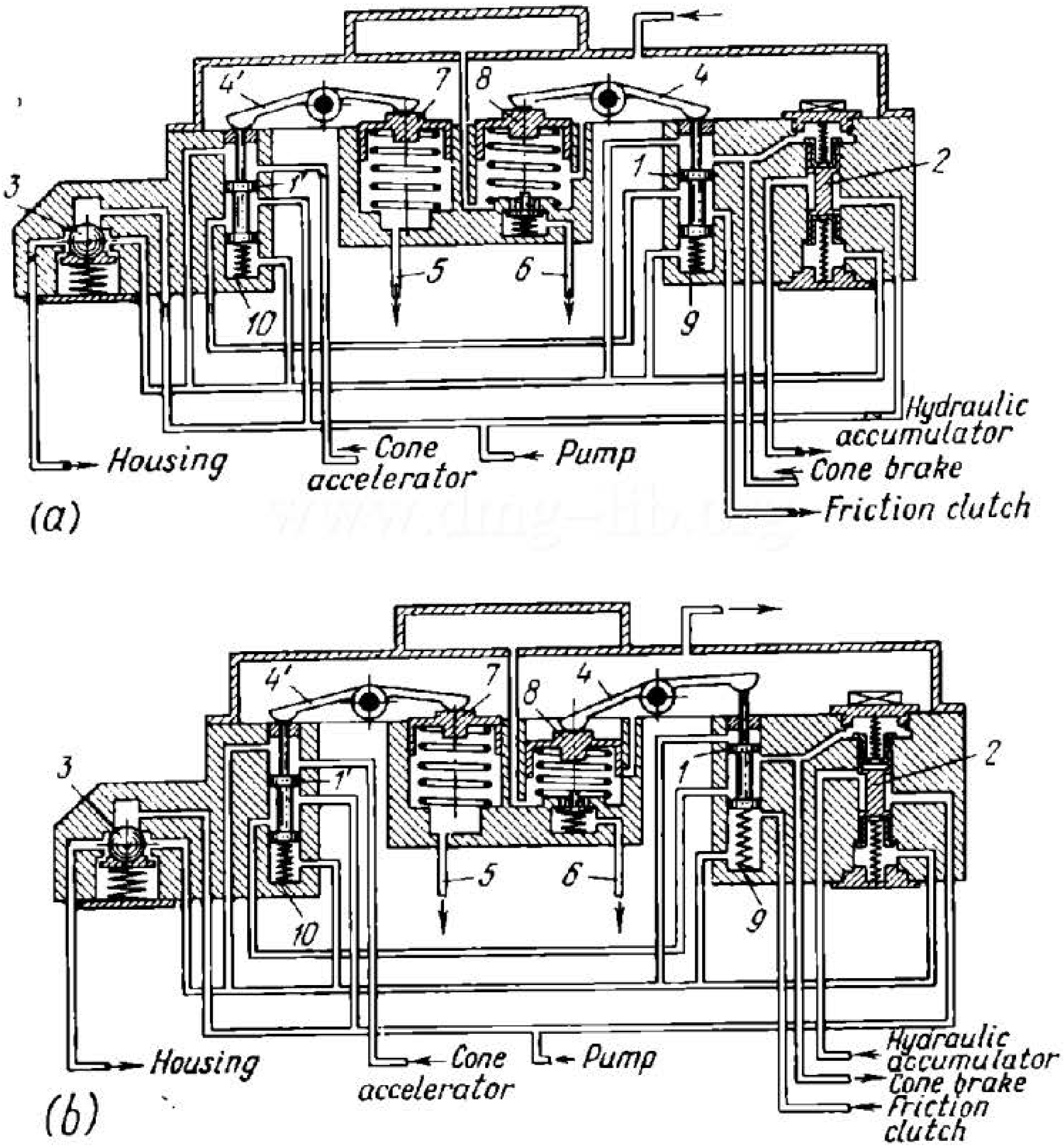
When the piston of servomotor *1* is moved downward by the action of fluid delivered to the cylinder, cable *2*, running over round pulleys *7*, *6* and *9* and attached to the servomotor housing at point *a*, turns lever *3* about fixed axis *A*. This lifts stem *4* which has pin *d* sliding in slot *b* of lever *3*. The conical tip at the lower end of stem *4* opens the hole in valve seat *5*, screwed into the body of the valve into which fluid is delivered. When the piston of servomotor *1* moves upward, the valve is closed by the action of weight *8* which can be adjusted to the required position along the axis of lever *3*.

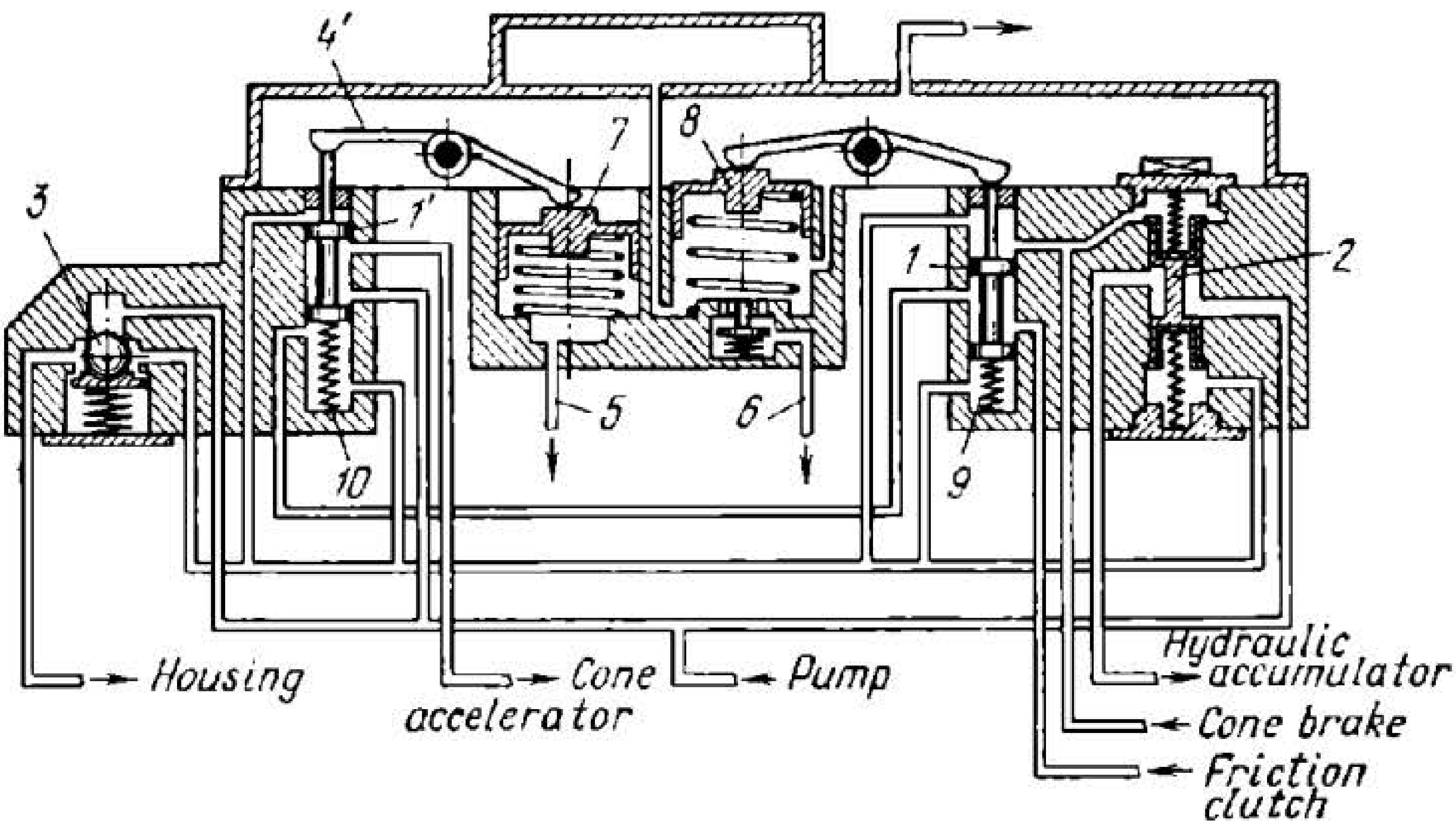
LEVER MECHANISM OF A BRAKE CONTROL VALVE



Pedal *1* turns about fixed axis *A* and is connected by turning pair *E* to spring link 7. When pedal *1* is depressed, rocker arm *2*, connected by turning pairs *C* and *D* to link *7* and to link *6*, pushes piston *3* upward. This opens valve *4* and fluid from the pump is delivered to the brakes. When pedal *1* is released to release the brakes, piston *3* moves downward and opens valve *4'*. At this, fluid from the brakes passes out of port *5* and drains to the tank.

3958	LEVER MECHANISM OF A BY-PASS VALVE	LHP Va

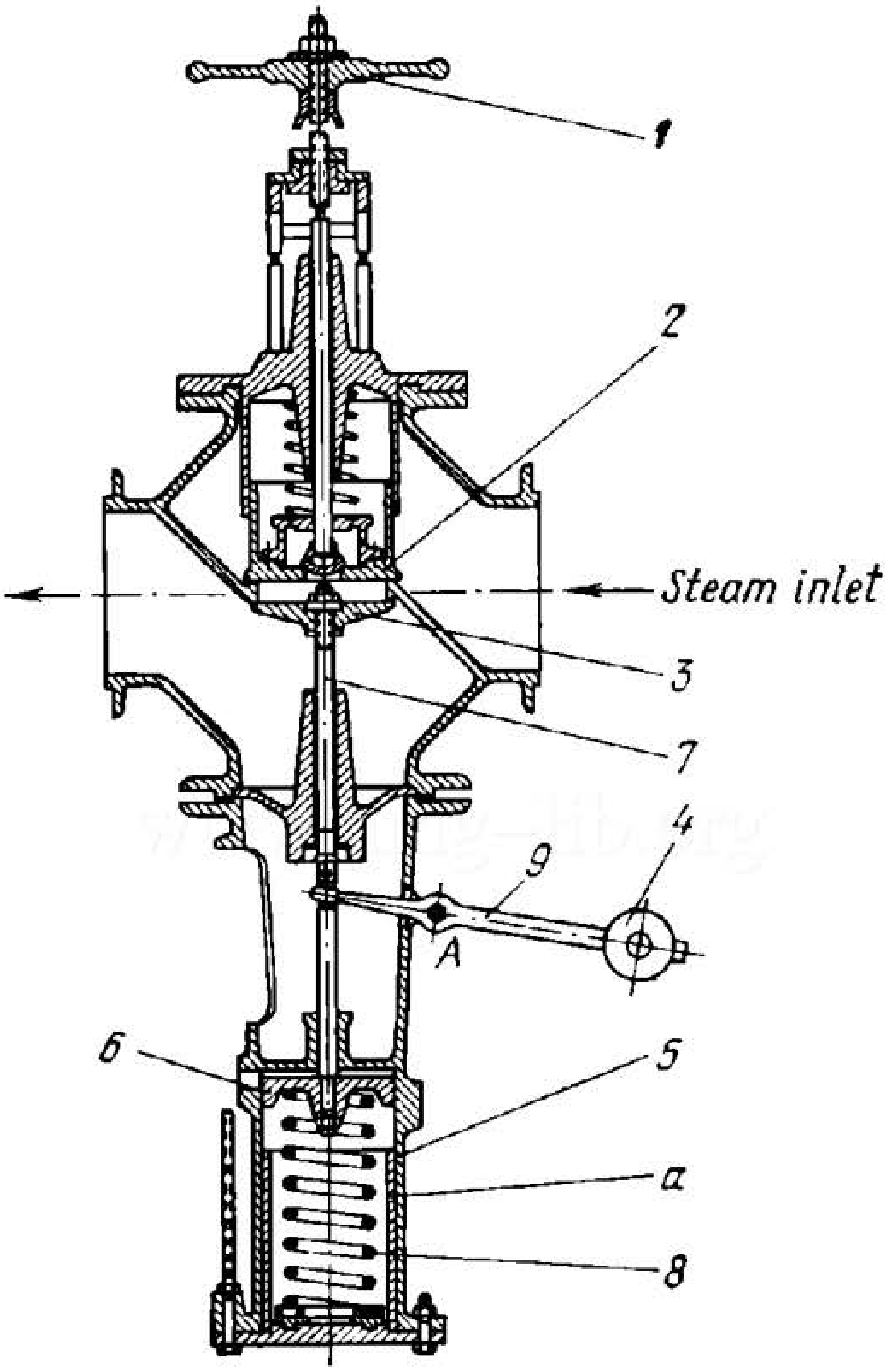




(c)

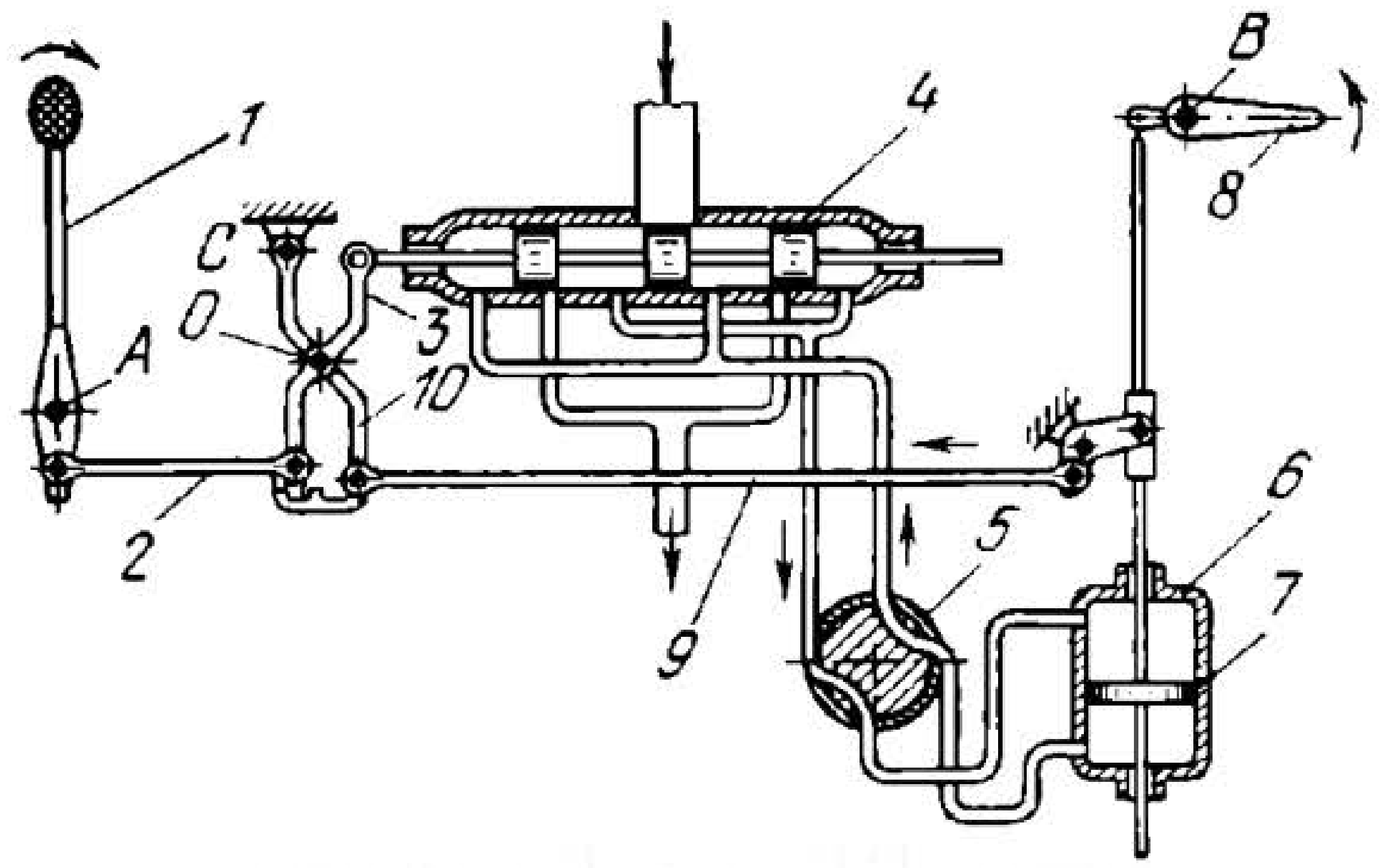
When pipelines *5* and *6* are connected to the atmosphere, the components of the valve are in the positions shown in Fig. *a*. Fluid delivered by the pump is directed through grooves of valve spools *1* and *1'* to the power cylinder of the friction clutch, engaging the clutch, and through regulating valve *2* to the hydraulic accumulator. The power cylinders of the accelerator and brake are connected to the housing. When a vacuum is set up in pipeline *6*, piston *8* moves downward, lever *4* is turned by spool *1* which is lifted by spring *9* (see Fig. *b*). At this, the pump delivers fluid under pressure to the accumulator which maintains the pressure in the system. Fluid from the hydraulic accumulator is delivered through regulating valve *2* and valves *1* and *1'* to the power cylinder of the brake. At the same time, fluid is admitted into the chamber above regulating valve *2*, shifting the spool downward. Fluid delivered from the accumulator is throttled through an orifice of regulating valve *2*. This gradually reduces the pressure in the system, ensuring smooth braking. The power cylinders of the accelerator and friction clutch are connected to the housing. When a vacuum is set up in pipeline *5*, piston *7* moves downward, lever *4'* is turned by spool *1'* which is lifted by spring *10* (see Fig. *c*). At this, the pump delivers fluid under pressure through a groove of valve spool *1'* to the power cylinder of the accelerator. The power cylinders of the friction clutch and the brake are now connected to the housing. Ball relief valve *3* protects the system against overloads.

3959	LEVER MECHANISM OF A STEAM TURBINE CHECK VALVE WITH A SERVOMOTOR	LHP Va



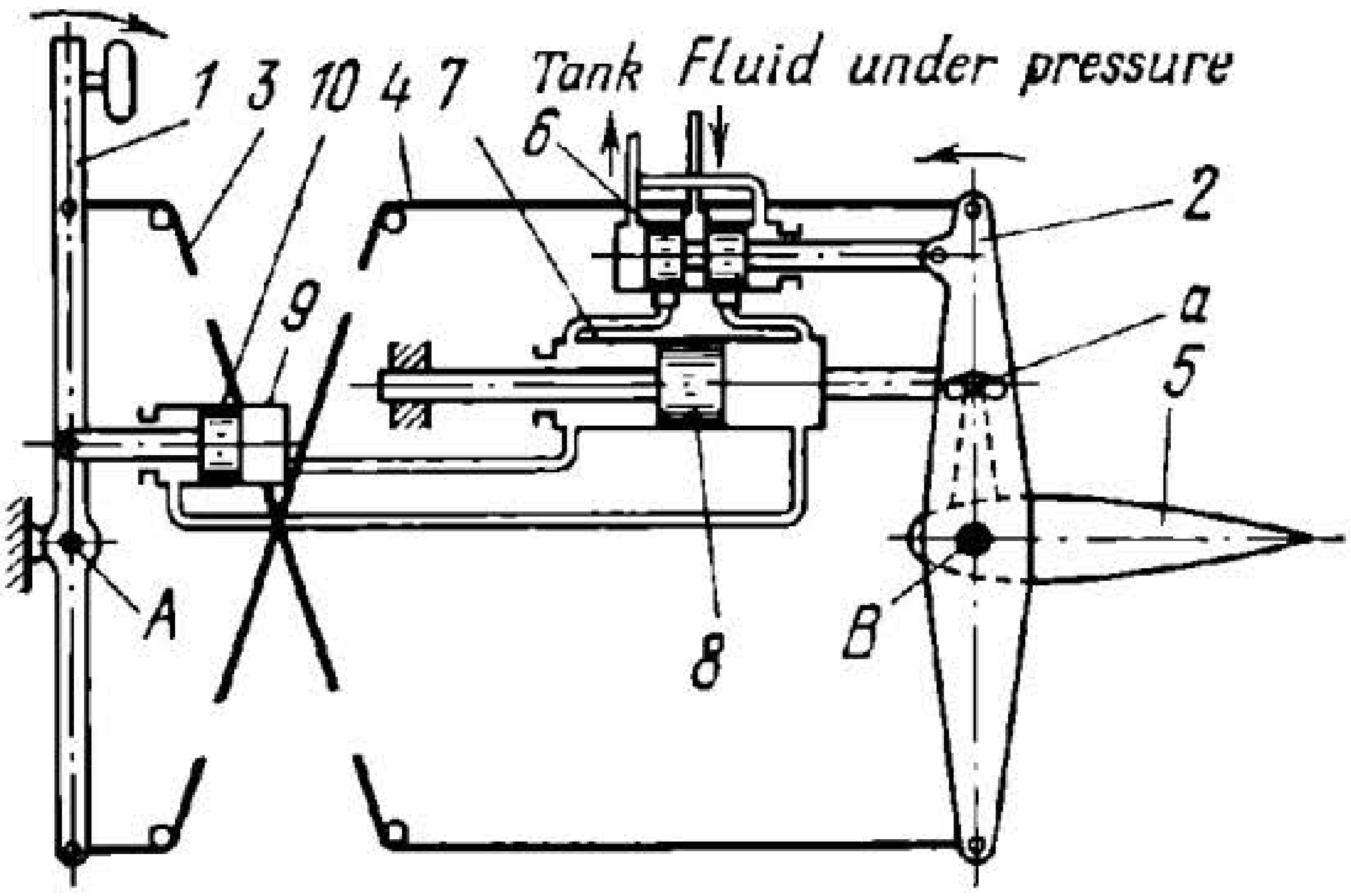
Handwheel *1* is turned manually to start the turbine. This lifts upper plate *2* of the valve. Steam, passing through the valve, forces lower plate *3* of the valve downward, turning lever *9* about fixed axis *A* and raising weight *4* which can be set at various places along the axis of lever *9*. Servomotor *5* is provided for rapidly closing the valve in case of a drop of load to prevent reversal of the steam. During normal operation of the steam turbine, fluid is delivered to the upper end of servomotor *5*. The pressure of the fluid holds piston *6* down against stop *a*, compressing spring *8*. At this, plate *3*, linked to rod 7 of the piston, is also in its lower position. Upon a drop of load, the upper end of the servomotor is connected to the drain. Spring *8* lifts piston *6* and rapidly raises lower plate *3* onto its seat, preventing steam reversal.

3960	LEVER MECHANISM FOR A REMOTE-CONTROLLED AIRCRAFT ELEVATOR	LHP Co



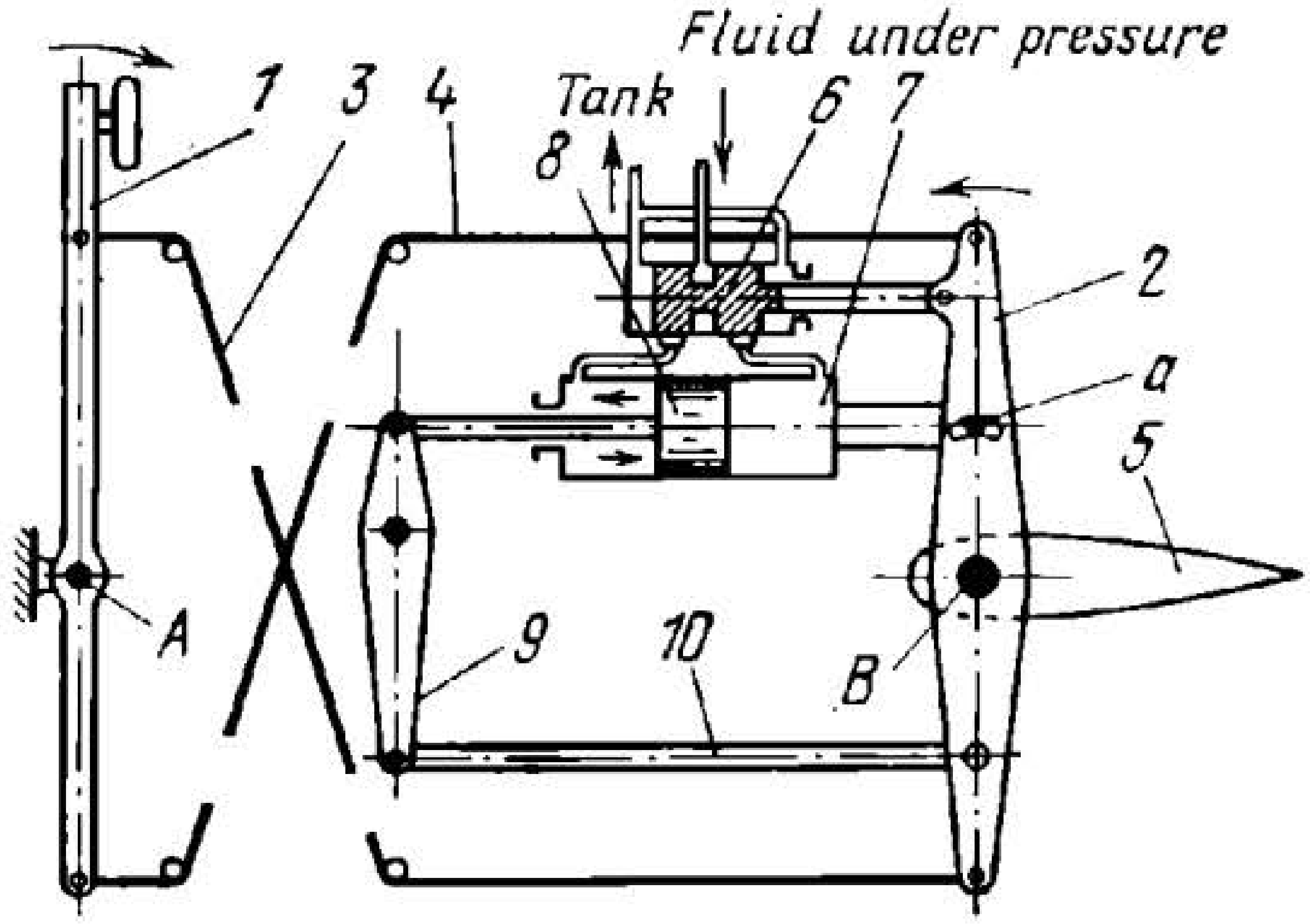
When lever *1* is turned clockwise about fixed axis *A*, tie-rod *2* turns lever *3* about axis *O*. A projection of lever *3* fits with a certain lengthwise clearance in a slot of link *10*. Valve spool *4* is shifted to the right. At this, a part of the fluid, admitted under pressure into the body of valve spool *4*, is delivered through rotary valve *5* to the top end of power cylinder *6*. Piston 7 moves downward so that elevator *8* is inclined upward. Fluid from the bottom end of cylinder *6* is drained through the valves to the tank. At the same time, a part of the fluid under pressure is admitted to the right end of spool *4*. This pressure is transmitted to the control lever. As elevator *8* is raised, turning about fixed axis *B*, tie-rod *9* turns lever *10* about fixed axis *C*. At the same time, lever *3* with axis *O* is displaced, enabling control lever *1* to continue to turn in the same direction. If control lever *1* is turned counterclockwise, the elevator is lowered.

3961	LEVER MECHANISM FOR A REMOTE-CONTROLLED AIRCRAFT ELEVATOR	LHP Co



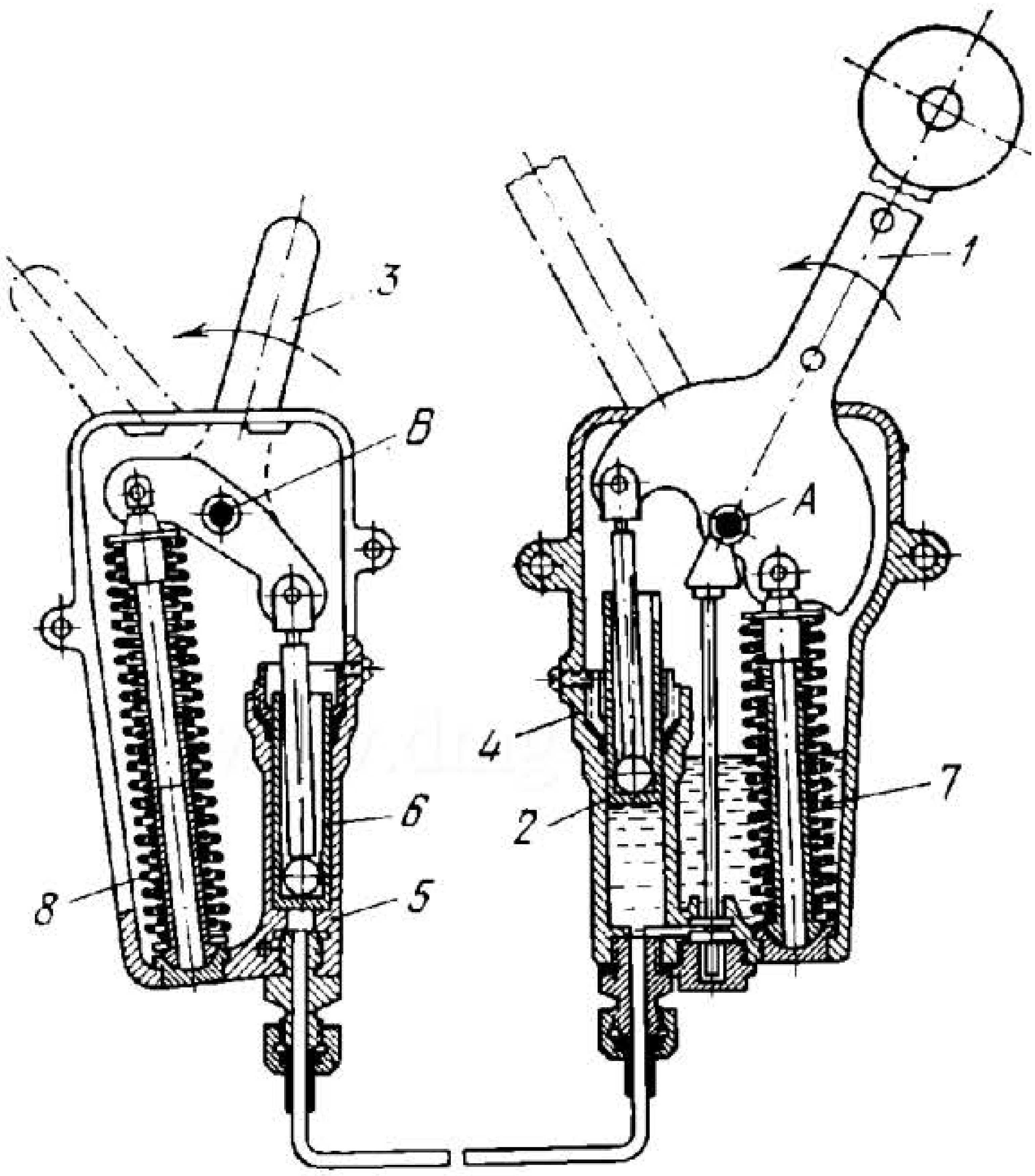
When lever *1* is turned clockwise about fixed axis *A*, lever *2*, linked to lever *1* by flexible cables *3* and *4*, turns in the opposite direction. Lever *2* turns about the same fixed axis *B* as elevator *5* and is hinged to the stem of valve spool *6*. The valve is mounted on power cylinder *7* of the elevator drive. As lever *2* turns, it shifts spool *6* to the left so that fluid under pressure is delivered to the left end of power cylinder *7*. Cylinder *7* is linked to lever *2* by pin *a*, fitting with some clearance in a slot of the lever. The rod of piston *8* is fixed. Cylinder *7* is moved to the left by the action of the fluid, turning the elevator. The ends of cylinder *7* are connected to the ends of cylinder *9*, right end to left end and vice versa. The rod of piston *10* is hinged to lever *1*. Thus, the effort required to turn lever *1* is proportional to the load on the elevator. The magnitude of this effort depends upon the ratio of cross-sectional areas of cylinders *7* and *9*. Fluid from the exhaust ends of cylinders *7* and *9* drains through grooves of valve spool *6* back to the tank. When lever *1* is turned in the opposite direction, the elements of the mechanism operate in the reverse direction.

3962	LEVER MECHANISM FOR A REMOTE-CONTROLLED AIRCRAFT ELEVATOR	LHP Co



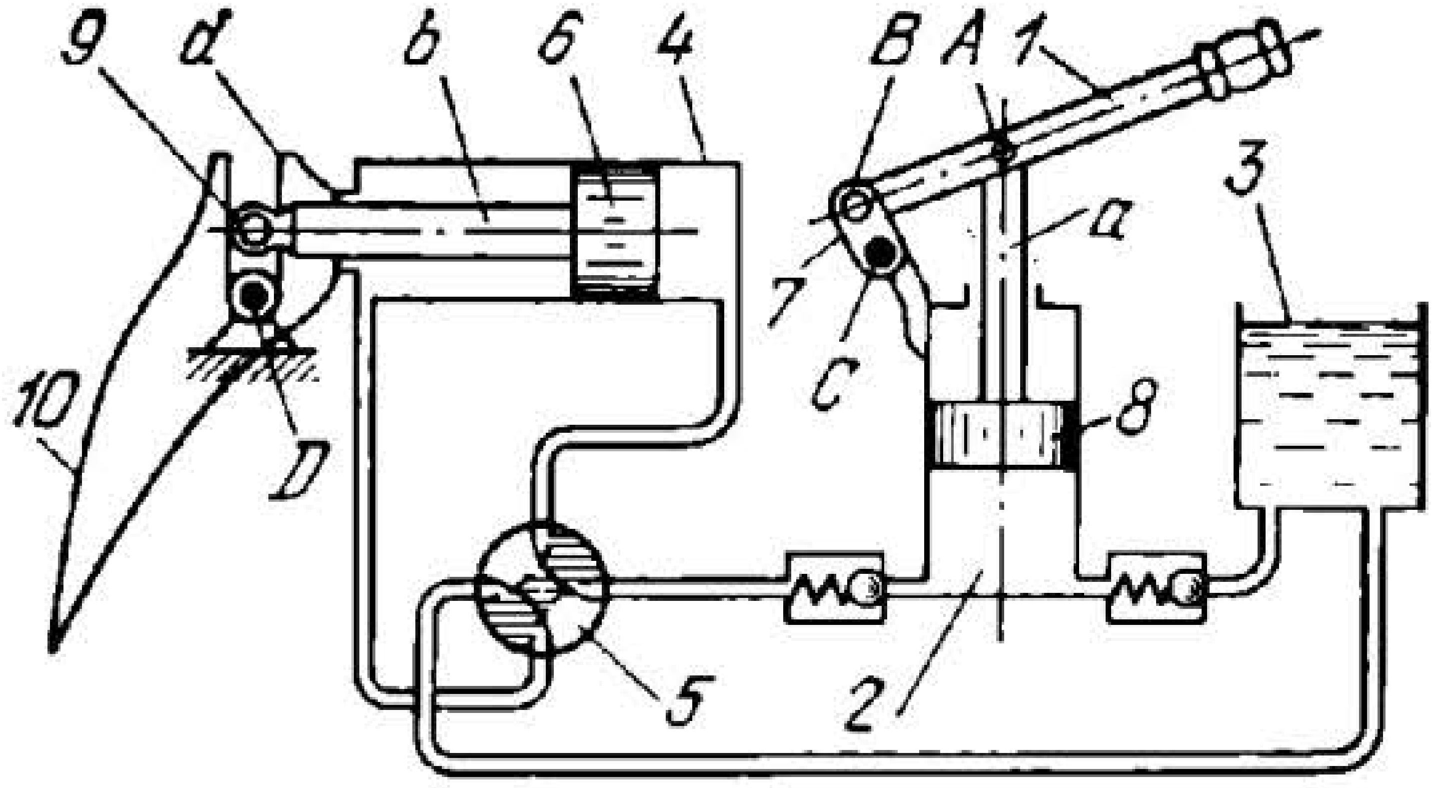
When lever *1* is turned clockwise about fixed axis *A*, lever *2*, linked to lever *1* by flexible cables *3* and *4*, turns in the opposite direction. Lever *2*, secured to elevator *5*, turns about fixed axis *B* and is hinged to the stem of valve spool *6*. The valve is mounted on power cylinder *7* of the elevator drive. As lever *2* turns, it shifts spool *6* to the left so that fluid under pressure is delivered to the left end of power cylinder 7. Cylinder *7* is linked to lever *2* by pin *a*, fitting with some clearance in a slot of the lever. The rod of piston *8* is linked to lever *2* through rocker arm *9* and tie-rod *10*, which are used so that the pilot can feel the load on the control lever. Cylinder *7* is moved to the left by the fluid, turning the elevator. On the other hand, the pressure of the fluid on piston *8* is transmitted through links *9* and *10* to lever *2* and, consequently, to control lever *1*. The force required to turn the control lever is determined from the moment of resistance of the elevator and the ratio of the lengths of the upper and lower arms of lever *9*. Fluid from the right end of cylinder *7* drains to the valve and back to the tank. If the motion of lever *1* is stopped at any point, spool *6* of the valve stops and its body, moving along with cylinder *7*, blocks off fluid delivery to the left end of cylinder *7*. When lever *1* is turned in the opposite direction, the elements of the mechanism operate in the reverse direction.

3963	LEVER MECHANISM FOR A REMOTE-CONTROLLED ENGINE THROTTLE	LHP Co



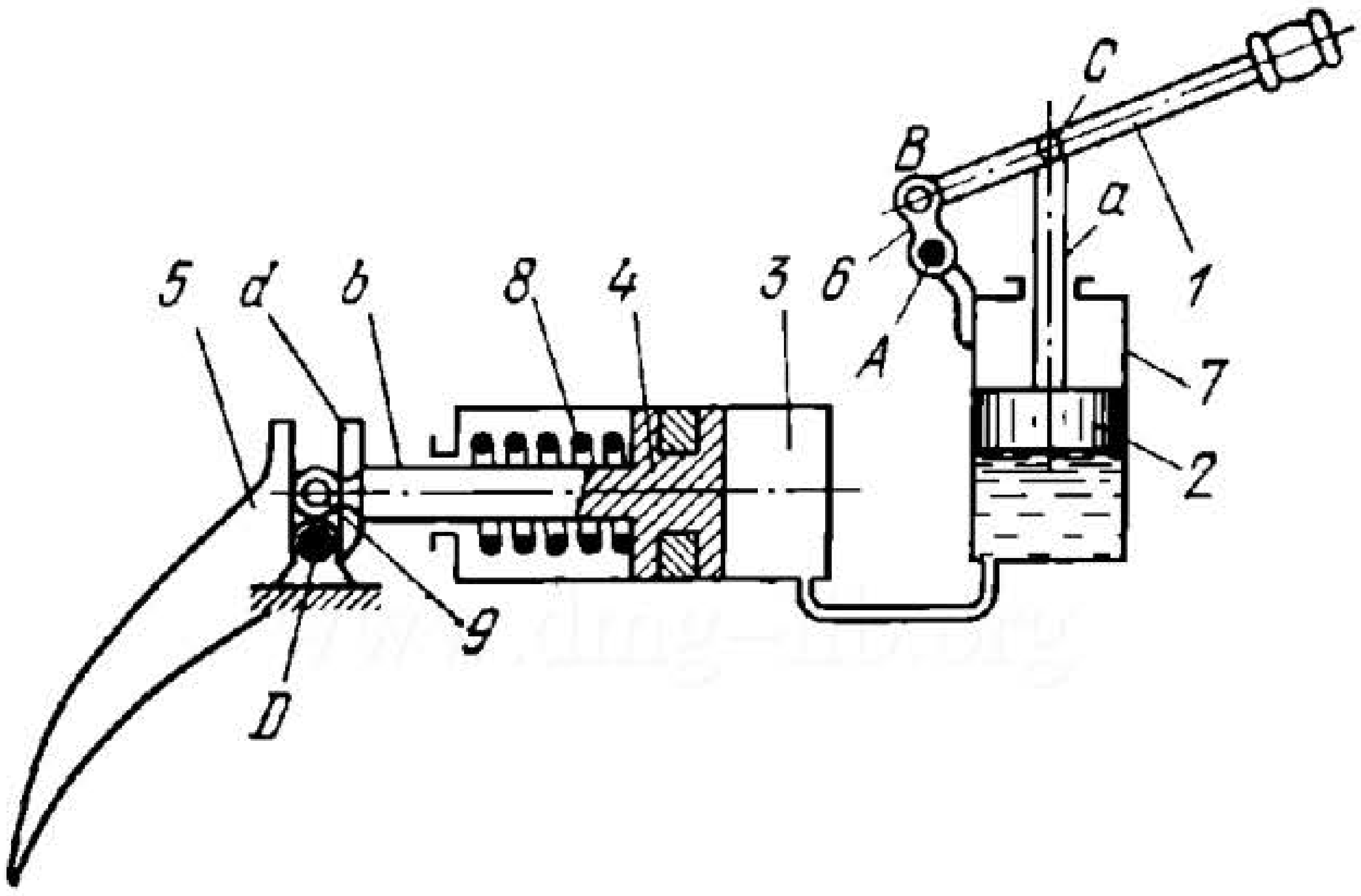
When control lever 1 is turned counterclockwise about fixed axis A, piston 2, whose rod is linked to lever 1, moves downward, forcing fluid from cylinder 4 into cylinder 5. Piston 6 is raised by the action of the fluid, turning lever 3, linked to the throttle, about fixed axis B. When control lever 1 is turned clockwise, piston 2 moves upward and piston 6 is moved downward by the action of spring 8. At this, lever 3 also turns clockwise. Spring 7 counterbalances spring 8.

3964	LEVER MECHANISM FOR LANDING FLAP CONTROL	LHP Co



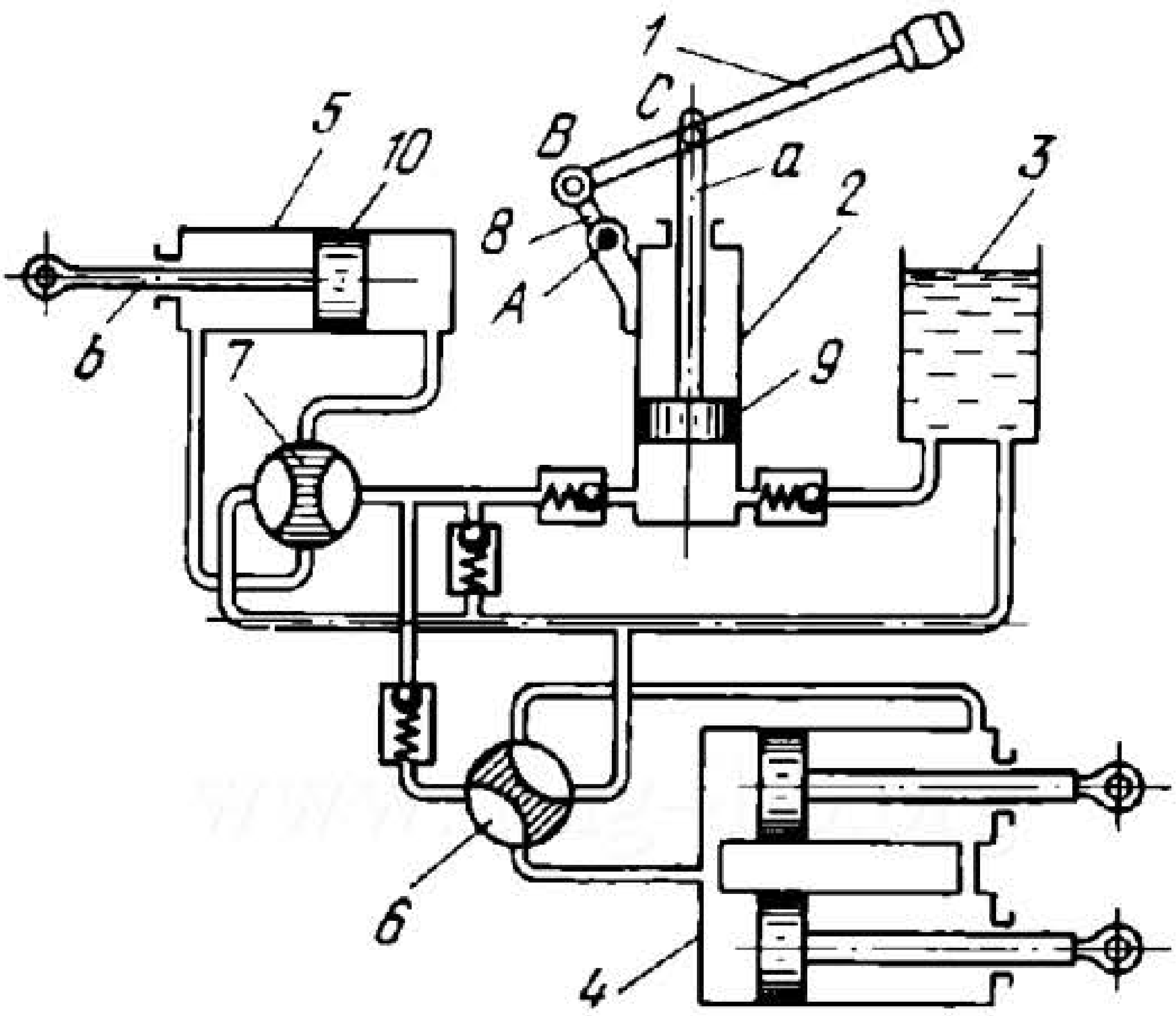
Lever *1* is connected by turning pairs *A* and *B* to rod *a* of piston *8* and to link *7* which turns about fixed axis *C*. Roller *9*, mounted at the end of rod *b* of piston *6*, rolls and slides in slot *d* of landing flap *10* which turns about fixed axis *D*. When lever *1* is oscillated, pump *2* draws in fluid from tank *3* and delivers it to one end of power cylinder *4*. Fluid from the opposite end of the cylinder is forced out through rotary valve *5* and drains back to tank *3*. Valve *5* can be turned to reverse the direction of motion of piston *6*. Piston *6* and, with it, landing flap *10* of the plane can be locked in any intermediate position by ceasing to pump and setting valve *5* in the neutral position.

LEVER MECHANISM FOR LANDING FLAP CONTROL



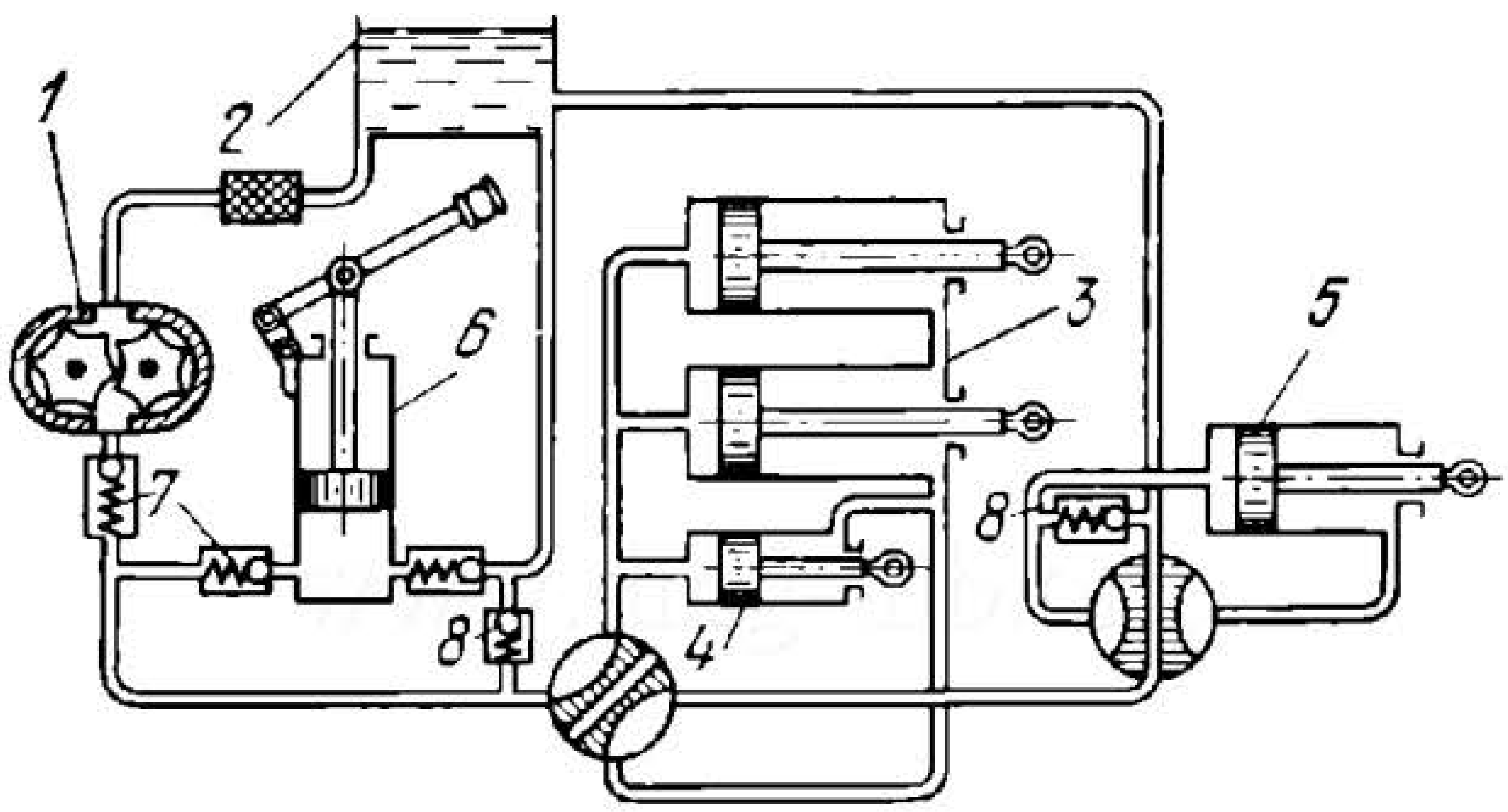
Control lever *1* is connected by turning pairs *B* and *C* to link *6*, turning about fixed axis *A*, and to rod *a* of piston *2*, which reciprocates in fixed cylinder *7*. Roller *9*, mounted at the end of rod *b* of piston *4*, rolls and slides in slot *d* of landing flap *5* which turns about fixed axis *D*. Piston *4* reciprocates in fixed cylinder *3*. When control lever *1* is turned clockwise, fluid is delivered into power cylinder *3*. This moves piston *4* to the left and its rod *b* turns landing flaps *5* of the plane. Piston *4* is moved to the right by spring *8*.

3966	LEVER MECHANISM FOR LANDING FLAP AND GEAR CONTROL	LHP Co



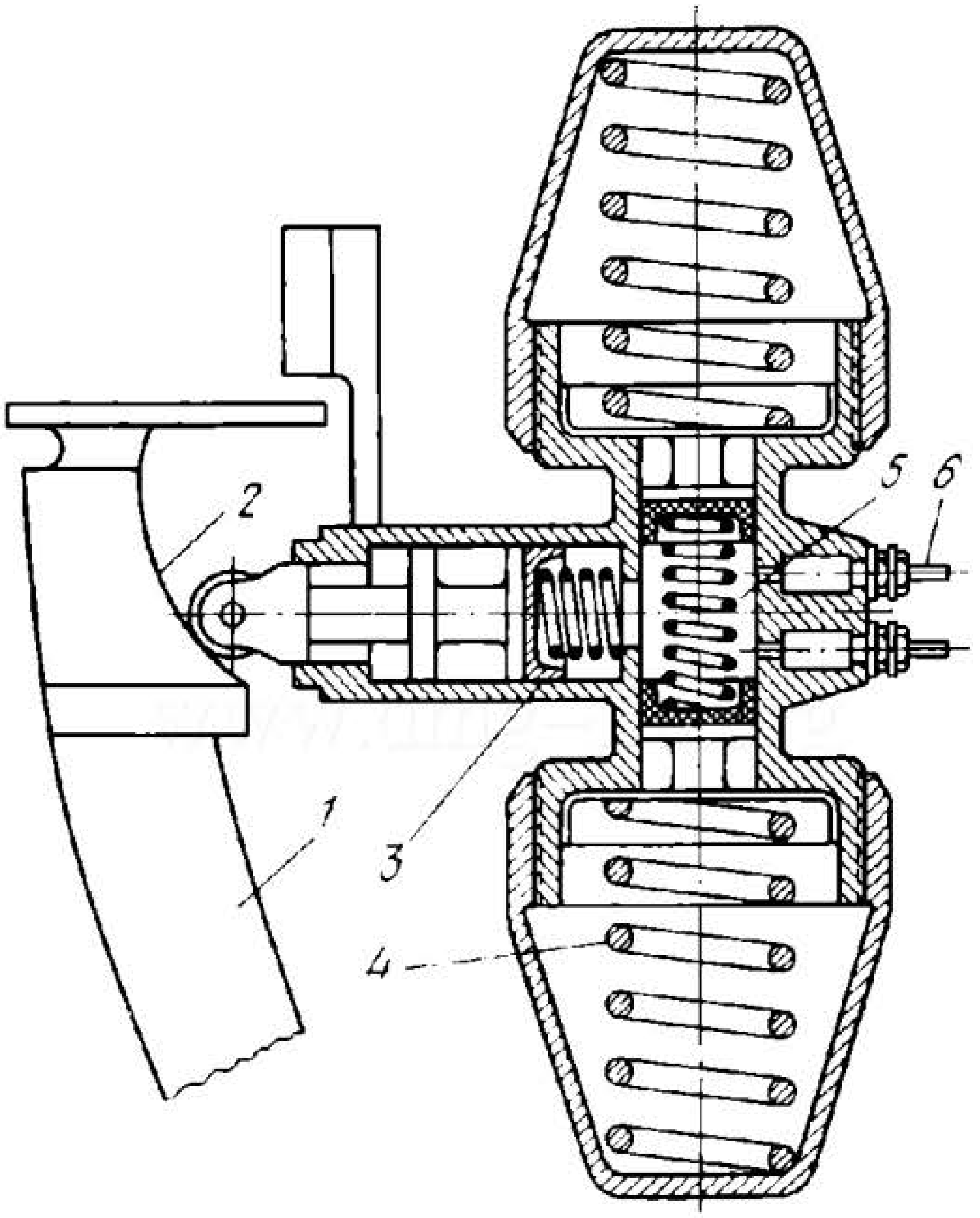
Lever *1* is connected by turning pairs *B* and *C* to link *8*, turning about fixed axis *A*, and to rod *a* of piston *9* which reciprocates in fixed pump cylinder *2*. Rod *b* of piston *10*, reciprocating in fixed cylinder *5*, is linked to the mechanism of the aircraft landing flaps (not shown). When lever *1* is oscillated, pump *2* draws in fluid from tank *3* and delivers it to power cylinders *4* of the landing gear or to power cylinder *5* of the landing flaps. Two rotary directional valves, *6* and *7*, connected in parallel, enable the landing gear and landing flap mechanisms to be separately controlled. Landing gear control valve *6* is shown turned on.

3967	LEVER MECHANISM FOR LANDING FLAP AND GEAR CONTROL WITH AN EMERGENCY DEVICE	LHP Co



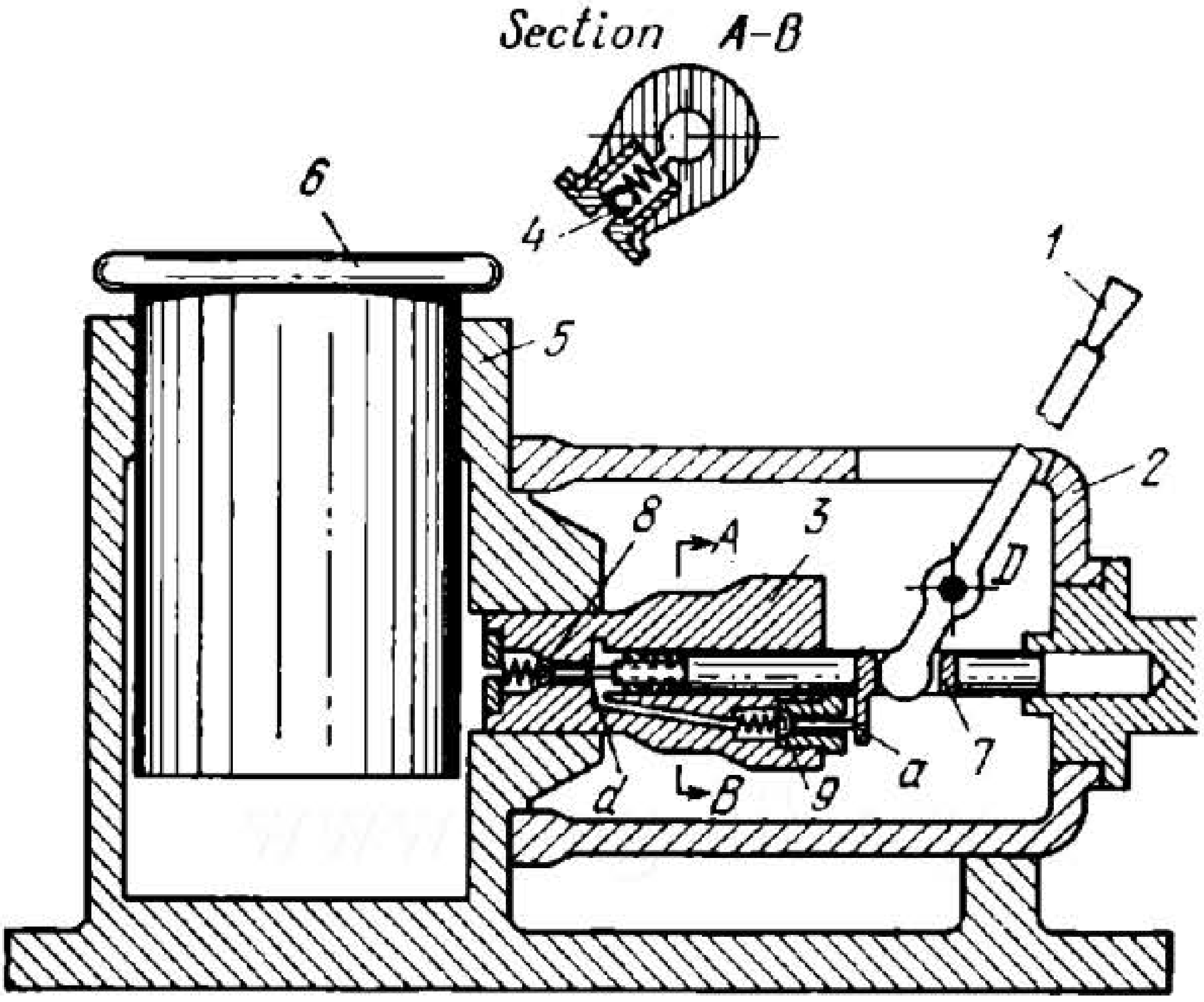
Gear pump *1* draws in fluid from tank *2* and delivers it to power cylinders *3* and *4* of the landing gear and skid or to power cylinders *5* of the landing flaps. Hand pump *6* is used in emergencies if the mechanical pump gets out of order. Valves *7* are check valves and valves *8* are relief valves.

3968	LEVER MECHANISM FOR CONTROLLING AIRCRAFT TAIL WHEEL BRAKE SHOES	LHP Co



At the moment skid *1* contacts the earth in landing, cam *2*, of suitable profile, moves piston *3* to the right. At this, fluid from chamber *5* is delivered through connections *6* to the brakes. Springs *4* take up a part of the force developed in braking.

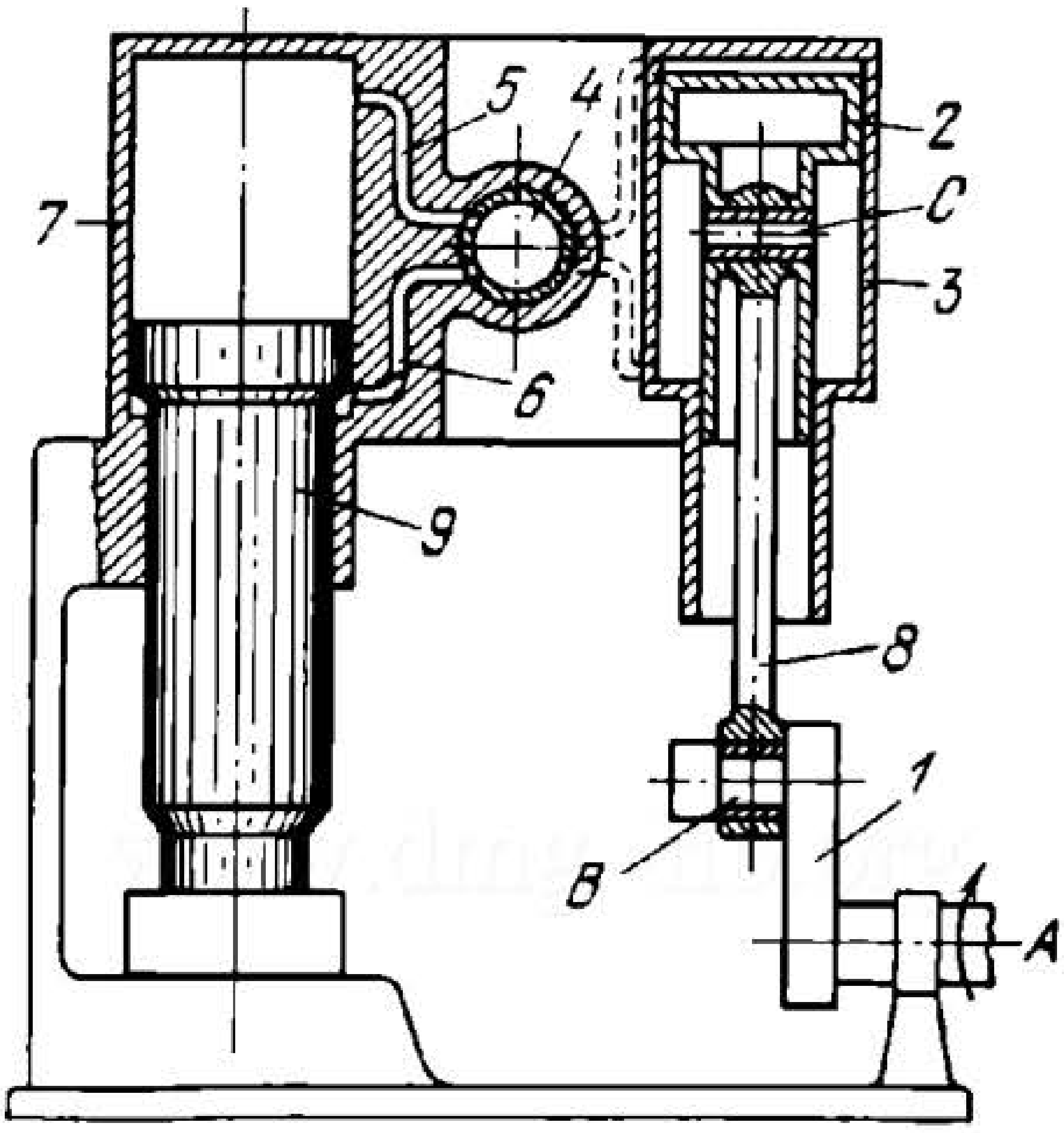
3969	LEVER MECHANISM OF A HYDRAULIC JACK	LHP MH



When lever 1 is turned counterclockwise about fixed axis D of the pump, fluid from tank 2 is drawn into cylinder 3 through suction valve 4. When lever 1 is turned in the opposite direction, fluid from the pump cylinder is delivered through opening ball-type discharge valve 8 into power cylinder 5, lifting plunger 6 of the jack together with the load. To lower the load, lever 1 is inclined clockwise somewhat farther than its extreme working position. At this, lug *a* of plunger 7 of the pump pushes back the ball of discharge valve 9, and pin *d* at the end of plunger 7 pushes back the ball of delivery valve 8. Both valves are opened and the fluid drains back to tank 2. The speed at which the load is lowered can be regulated by opening valves 8 and 9 more or less.

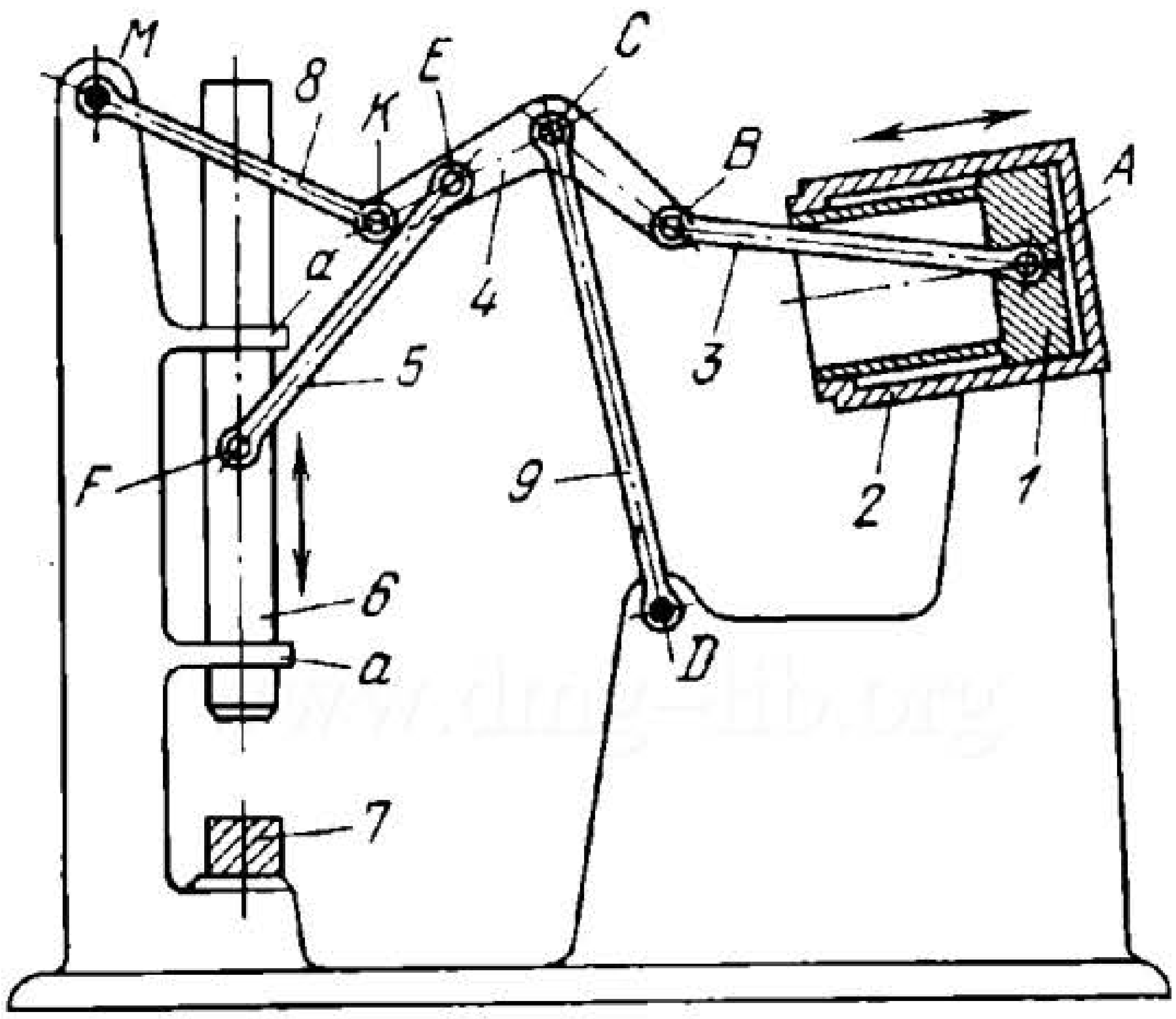
11. HAMMER, PRESS AND DIE MECHANISMS
(3970, 3971 and 3972)

3970	LEVER MECHANISM OF A PNEUMATIC POWER HAMMER	LHP HP



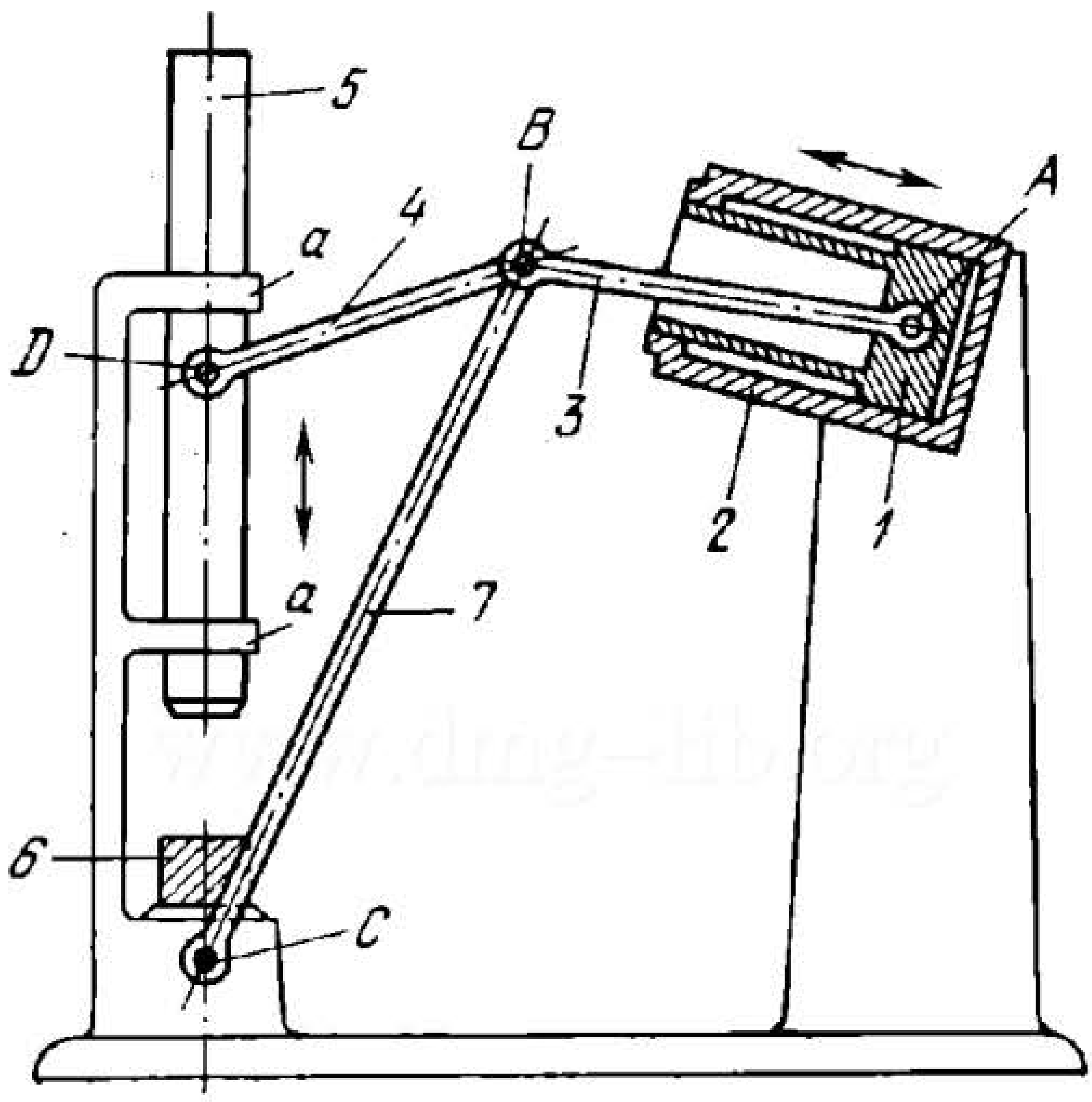
Crank *1* rotates about a fixed axis. Connecting rod *8* is connected by turning pairs *B* and *C* to crank *1* and to piston *2* which reciprocates in pneumatic cylinder *3*. When crank *1* rotates, motion is transmitted to piston *2* of cylinder *3* from which compressed air is delivered through valve *4* and passages *5* and *6* to power cylinder *7*. Depending upon the position of valve *4*, controlled by a special mechanism (not shown), air passes either through passage *5*, in which case ram *9* is driven downward to strike a blow, or through passage *6* in which case the ram is lifted for the next blow.

3971	LEVER MECHANISM OF A HYDRAULIC PRESS	LHP HP



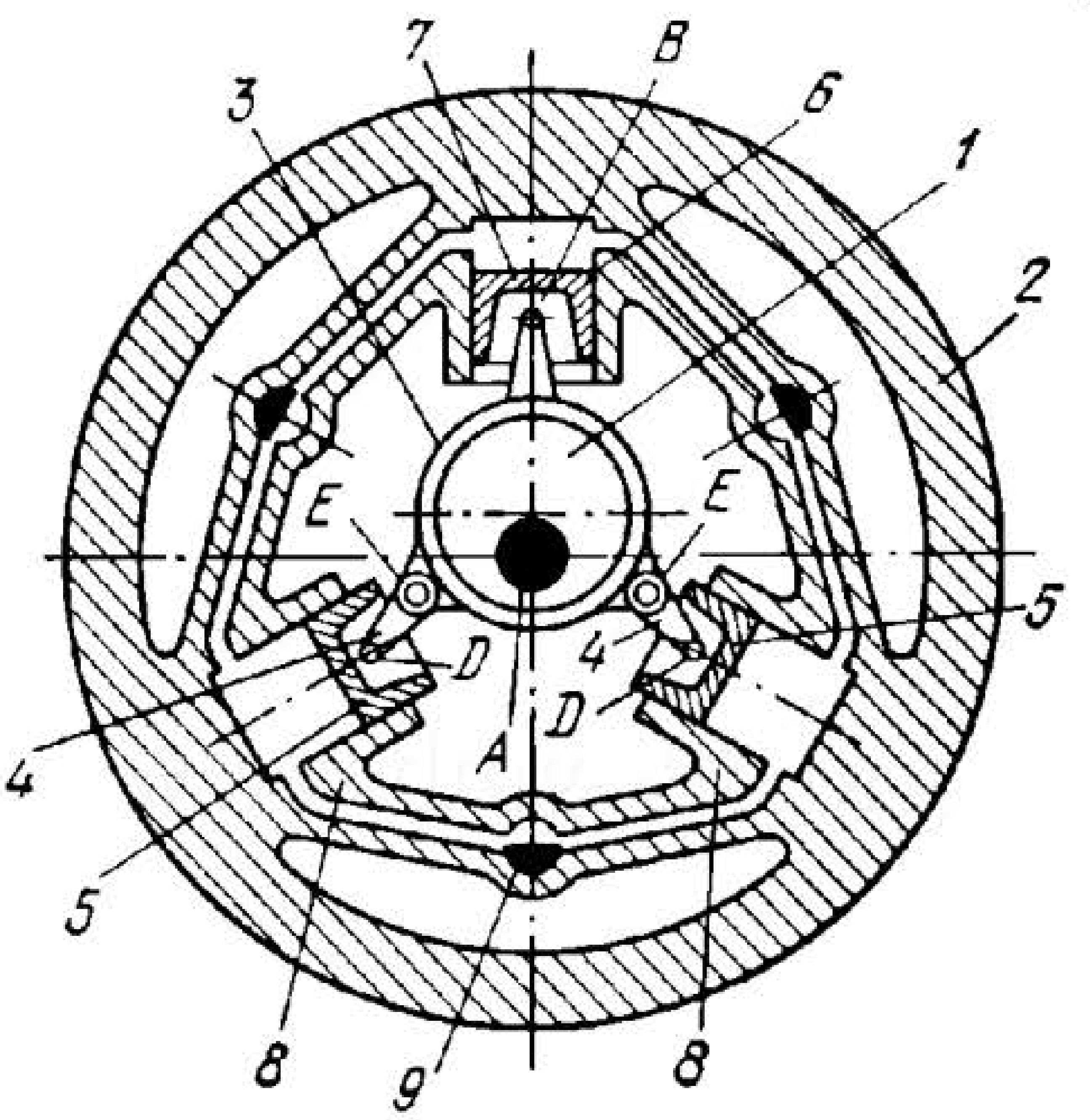
Piston *1* reciprocates in fixed hydraulic cylinder *2*. Connecting rod *3* is connected by turning pairs *A* and *B* to piston *1* and to bell-crank lever *4* which is connected by turning pairs *C*, *E* and *K* to links *9*, *5* and *8*. Links *8* and *9* turn about fixed axes *M* and *D*, and link *5* is connected by turning pair *F* to ram *6* of the press. Ram *6* reciprocates in fixed guides *a*. Pressure is applied to billet *7* when piston *1* travels to the left.

3972	LEVER MECHANISM OF A HYDRAULIC PRESS	LHP HP



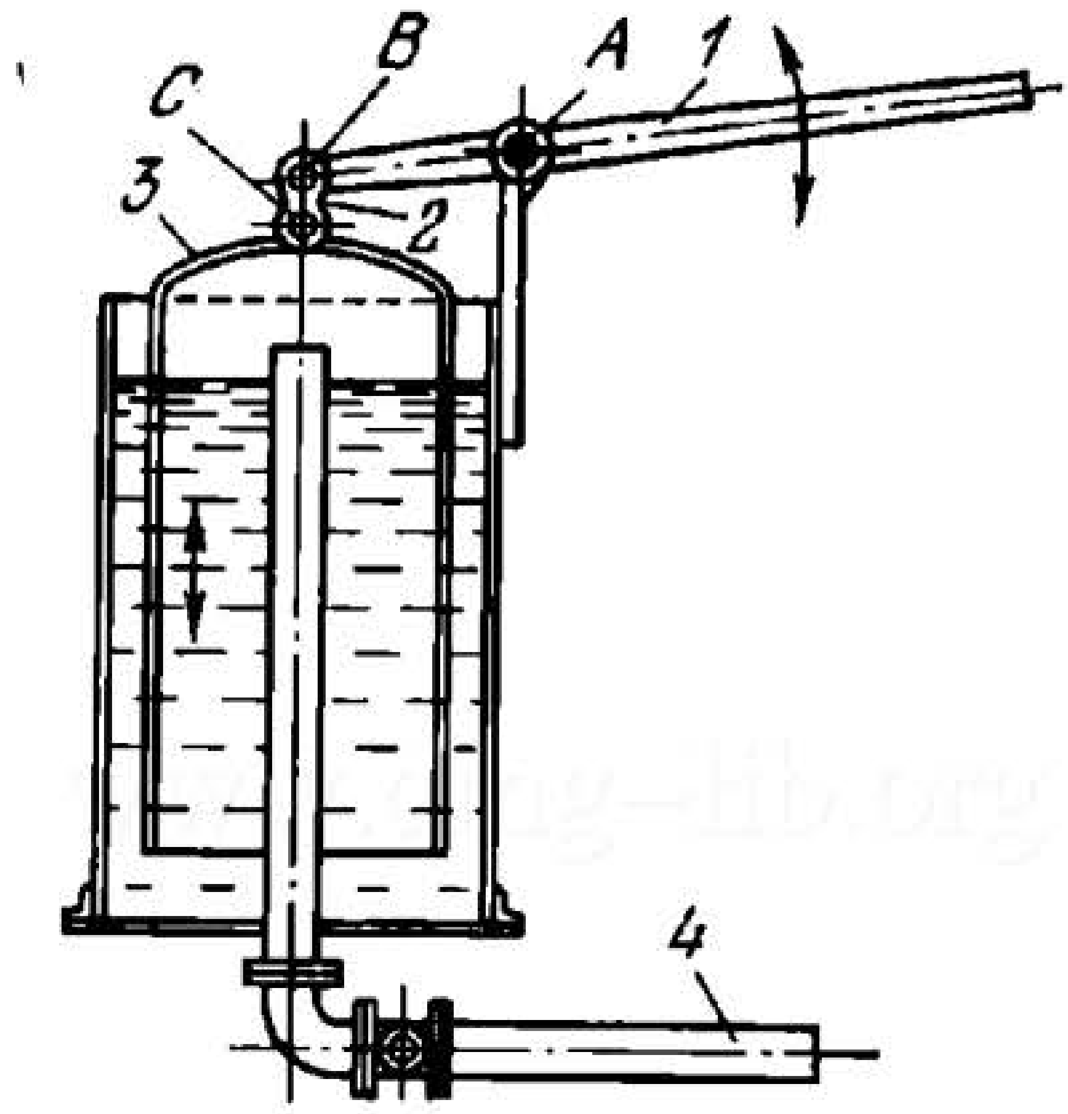
Piston *1* reciprocates in fixed hydraulic cylinder *2*. Connecting rod *3* is connected by turning pairs *A* and *B* to piston *1* and to rocker arm *7* which turns about fixed axis *C*. Link *4* is connected by turning pairs *B* and *D* to rocker arm *7* and to ram *5* of the press. Ram *5* reciprocates in fixed guides *a*. Pressure is applied to billet *6* when piston *1* travels to the left.

3973	LEVER-ECCENTRIC MECHANISM OF A HYDRAULIC PISTON-TYPE CLUTCH	LHP C



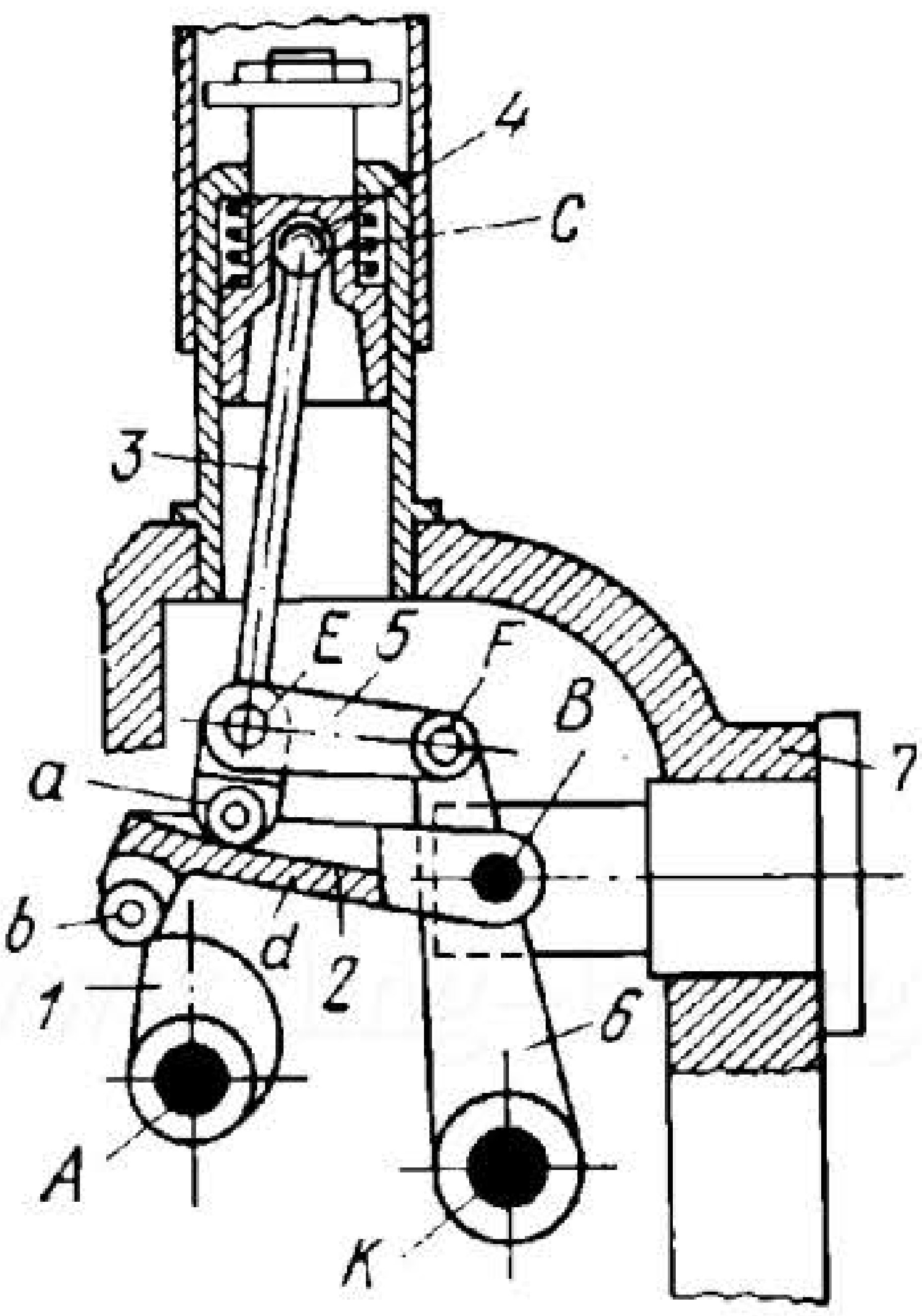
Eccentric *1* rotates about fixed axis *A* and is encircled by collar *3* which is connected by turning pair *B* to piston *7*. Piston *7* slides in cylinder *6*. Connecting rods *4* are connected by turning pairs *E* and *D* to collar *3* and to pistons *5* which slide in cylinders *8*. Rotation is transmitted from the drive shaft, on which eccentric *1* is mounted, to the driven shaft, linked to cylinder block *2*, through collar *3*, connecting rods *4* and pistons *5*. The working ends of the cylinders are connected together by passages in which flow-control valves *9* are installed. These valves vary the speed ratio.

3974	LEVER MECHANISM OF A GAS-HOLDER-TYPE MANUAL AIR BLOWER	LHP FD



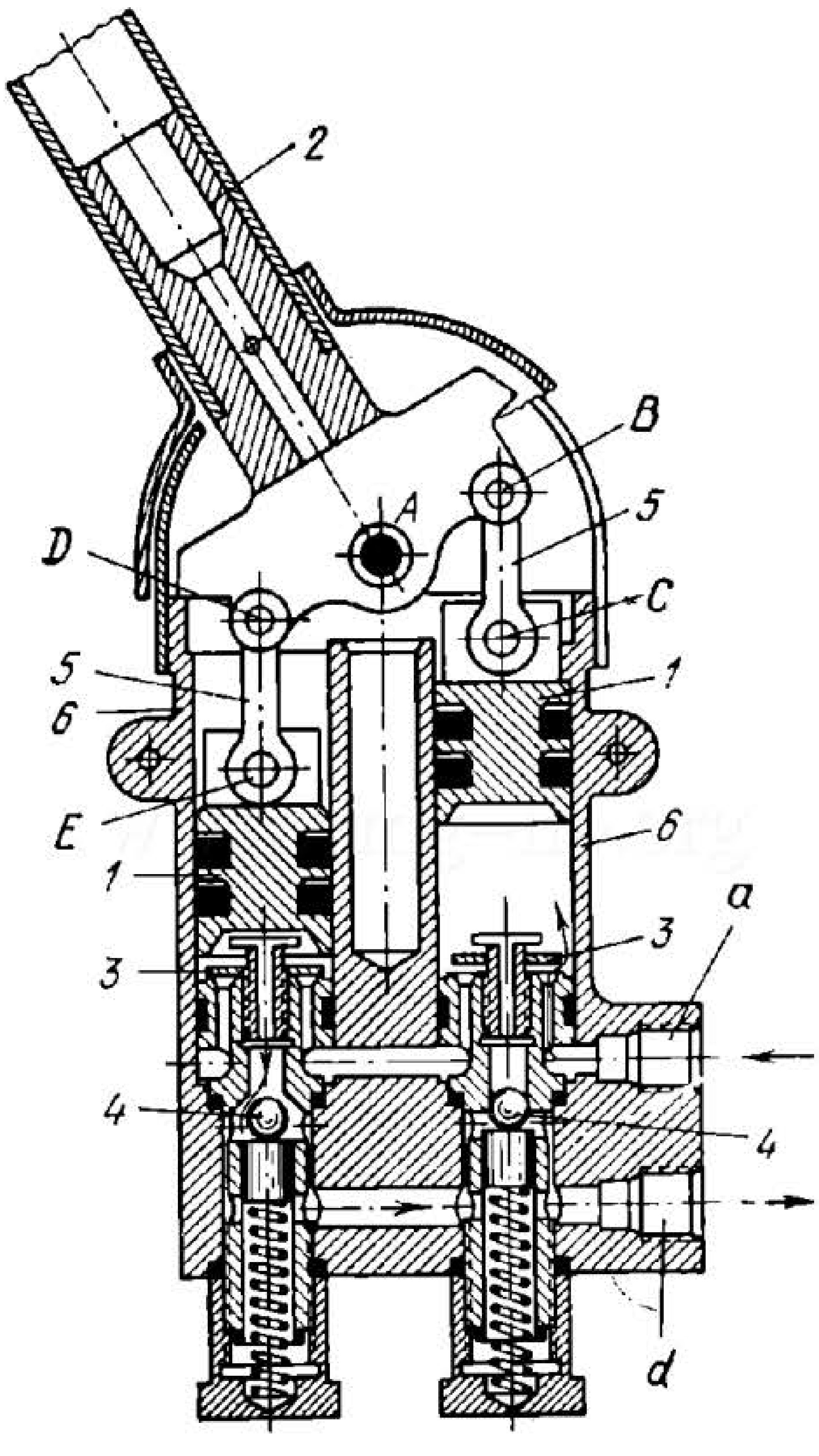
Lever 1 turns about fixed axis A. Link 2 is connected by turning pairs B and C to lever 1 and to bell member 3. When lever 1 is oscillated, the pressure under bell member 3 is alternately reduced and increased. This is used to pump air into pipeline 4.

3975	LEVER-CAM MECHANISM OF A FUEL PUMP	LHP FD



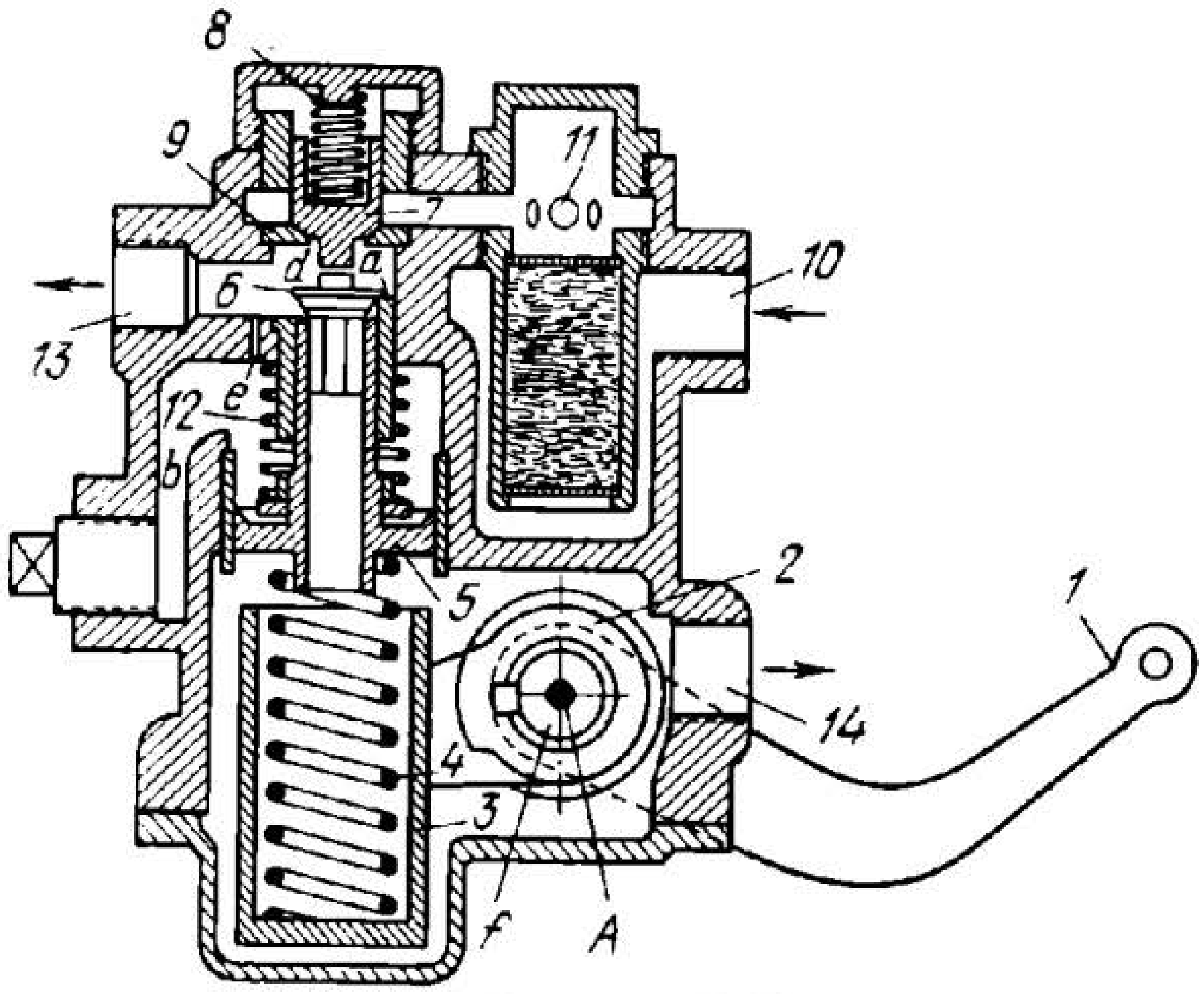
Cam *1* rotates about fixed axis *A*. Lever *2* turns about fixed axis *B* of component 7 and its roller *b* rolls along the surface of cam *1*. Lever *2* has profiled surface *d* along which roller *a* of connecting rod *3* rolls. Connecting rod *3* is connected by turning pair *C* to slider *4*. Link *5* is connected by turning pairs *E* and *F* to connecting rod *3* and to rocker arm *6* which turns about fixed axis *K*. When cam *1* rotates, lever *2* oscillates. Slider *4* is linked to the plunger of the fuel delivery pump. Fuel delivery can be regulated by turning rocker arm *6*. This varies the stroke of slider *4* and, consequently, the amount of fuel delivered per stroke.

3976	LEVER MECHANISM OF A HAND PUMP	LHP FD

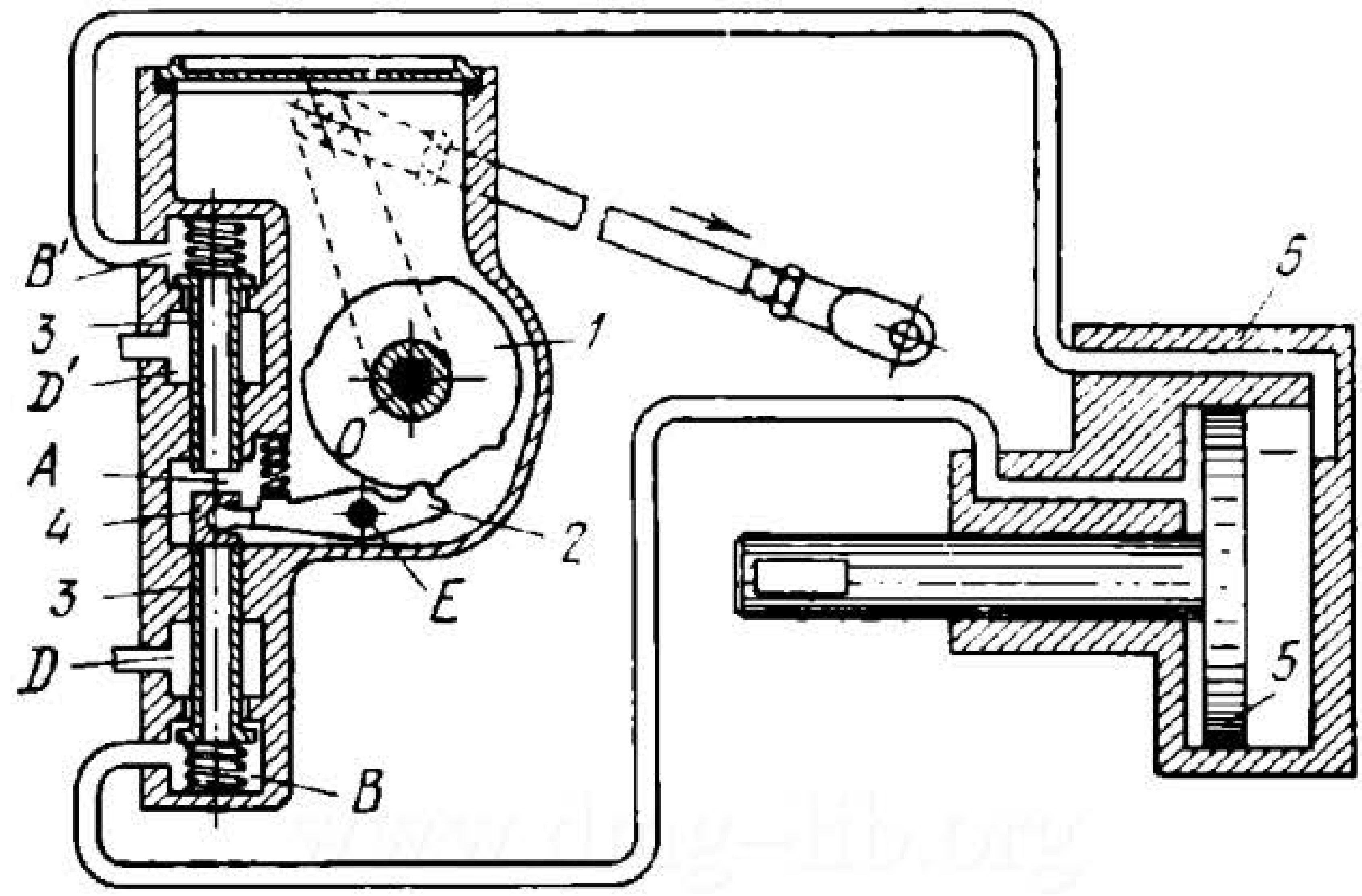


Lever 2 turns about fixed axis A and is connected by turning pairs D and B to two connecting rods 5 of equal length, which are connected by turning pairs E and C to pistons 1. Pistons 1 reciprocate in fixed cylinders 6. Pistons 1 are reciprocated by rocking lever 2 manually. This draws in fluid through port a and poppet valves 3, and delivers it through ball discharge valves 4 to discharge port d.

3977	LEVER MECHANISM OF A BRAKE APPLICATION VALVE	LHP FD

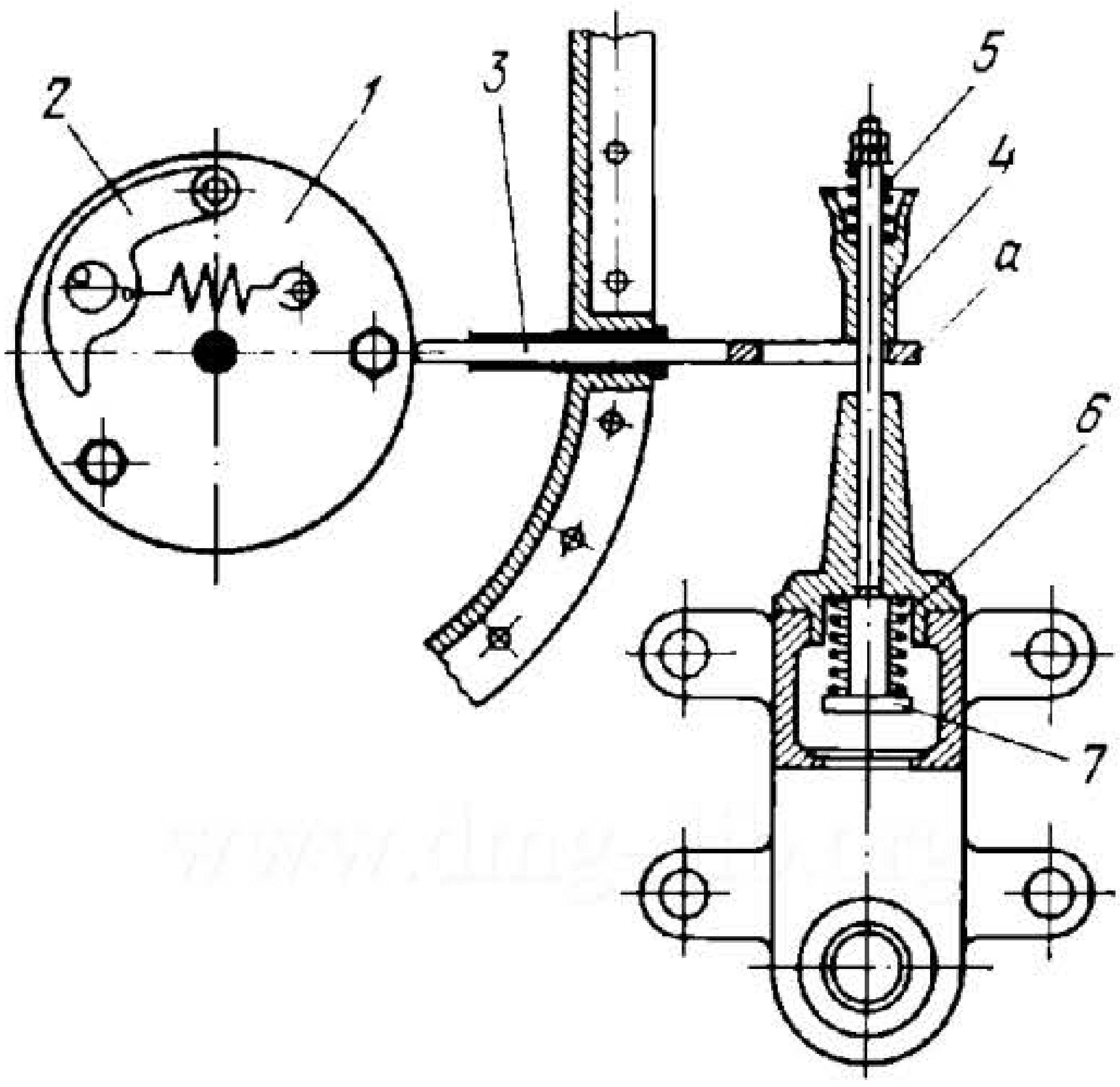


When lever *1*, linked to the brake pedal, is turned about fixed axis *A*, shaft *f* is turned together with fork *2*, keyed to shaft *f*. By means of sleeve *3* and spring *4*, fork *2* pushes piston *5* upward in the housing guides. The upper guide has lug *a* which prevents discharge valve member *6* from dropping below a certain definite point. The hollow rod of piston *5* has a conical bore into which valve member *6* seats, disconnecting the upper and lower chambers, *d* and *b*, of the housing. When valve member *6* is raised, chambers *d* and *b* are connected together owing to a flat milled on the left side of the stem of valve member *6*. Delivery valve *7*, at the top of the housing, is held in its seat *9* by spring *8*. Compressed air is delivered from the tank to the brake application valve through ports *10* and *11* to delivery valve *7*. In the absence of braking action, piston *5* is in its lower position owing to the action of spring *12*. Delivery valve *7* is closed and discharge valve *6* rests on lug *a*. Chamber *d*, connected with the brake chambers through port *13*, is also connected, in this case, with chamber *b* and with the atmosphere through port *14*. When the brake pedal is depressed, piston *5* moves upward and valve member *6* is seated in the piston rod, disconnecting chambers *b* and *d*. Upon further movement, valve member *6* pushes up valve *7*, opening it and admitting compressed air into the brake chambers. At the same time, due to the provision of passage *e*, the pressure above piston *5* increases, shifting it downward together with valve member *6*. Valve *7* is also moved downward by spring *8*. The pressure of the air in the brake chambers stops increasing. If the force applied to the brake pedal is increased, valve *7* opens again and admits additional compressed air to the brake chambers. If the force applied to the pedal is reduced, piston *5* moves downward and valve member *6* is held by lug *a* so that a part of the air from the brake chambers is discharged to the atmosphere, releasing the braking effect to some extent. After this, the equilibrium positions of the piston and valves are re-established. When the pedal is released, air from the brake chambers is discharged to the atmosphere and braking action ceases. The pressure of the air delivered to the brake cylinders is regulated by limiting the stroke of lever *1*.



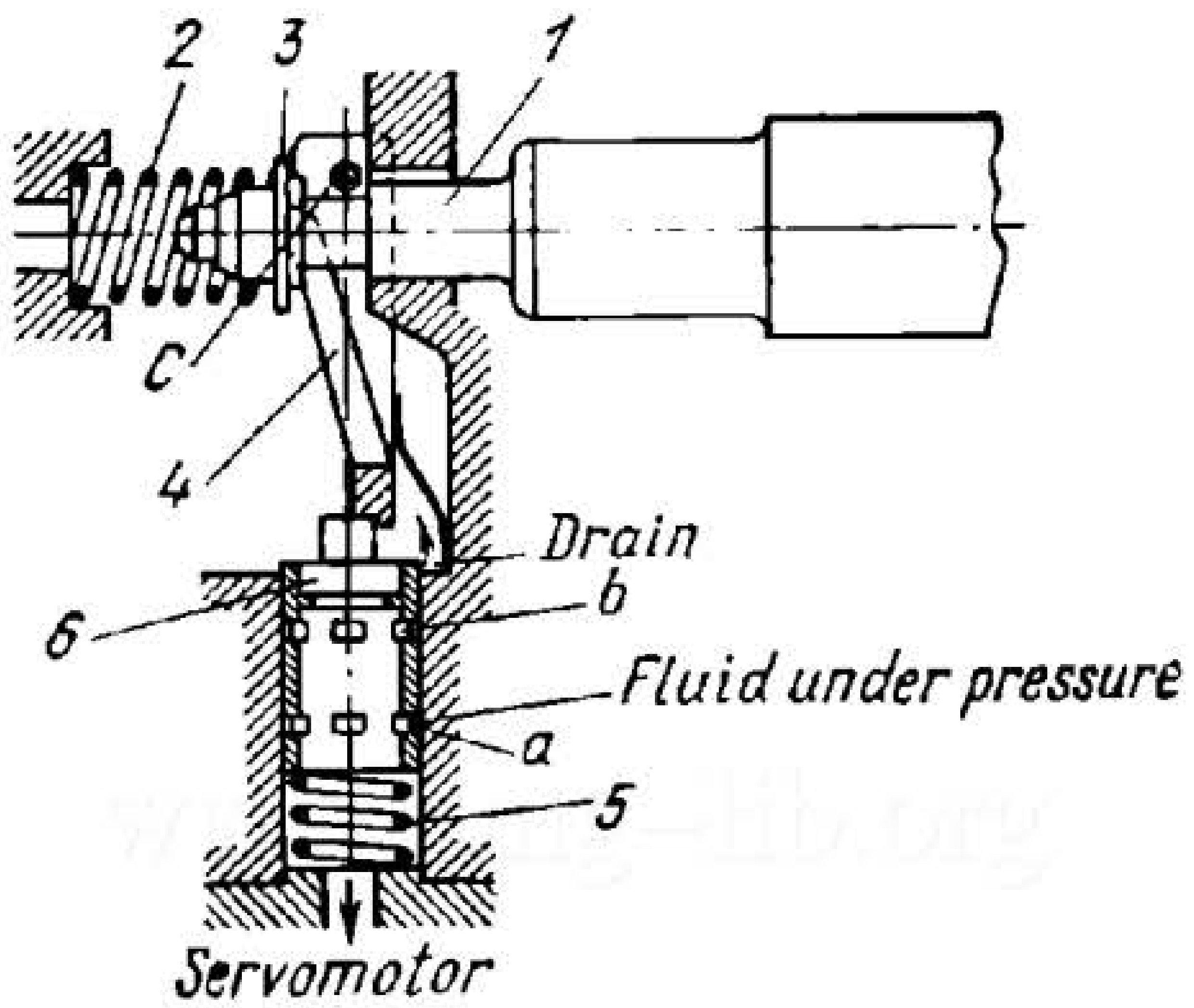
When cam *1* rotates about fixed axis *O*, lever *2*, turning about fixed axis *E* and having valve member *4* at one end, brings member *4* into contact with one or the other hollow plunger *3*, depending upon the position of cam *1*. The pertinent plunger *3* is shifted and chambers *A* and *D* (or *A* and *D'*) are disconnected, and chambers *D* and *B* (or *D'* and *B'*) are connected together. If chambers *D* and *D'* are connected to the atmosphere, then piston *5*, travelling in cylinder *6* whose ends are connected to chambers *B* and *B'*, is in equilibrium. If a vacuum is set up in chambers *D* and *D'*, and with lever *2* in the position shown, piston *5* moves to the left because a vacuum is set up at the left end of cylinder *6*. The right end is connected through a pipeline and hollow plunger *3* to chamber *A* and, consequently, to the atmosphere. The motion of piston *5* shifts the gears. When valve member *4* closes upper plunger *3*, piston *5* moves to the right.

3979	LEVER MECHANISM FOR AUTOMATICALLY STOPPING AN ENGINE	LHP FD



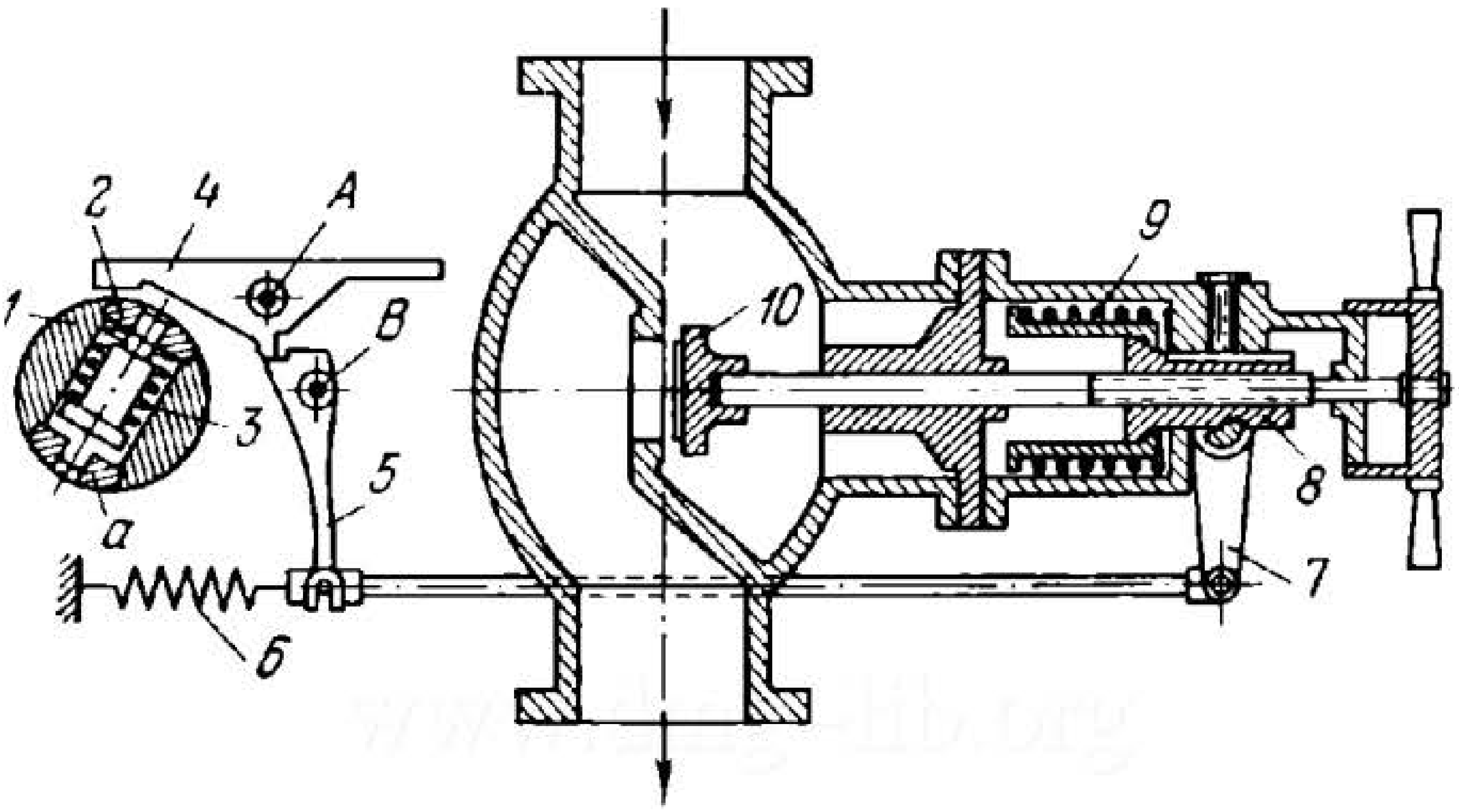
When an engine, on whose shaft disk *1* is mounted, exceeds a preset speed, weight *2* moves outward, beyond the circumference of the disk, as a result of centrifugal force and strikes the end of rod *3*. When rod *3* moves to the right, ring *a* releases sleeve *4*. While the engine is running at normal speed, sleeve *4* is held against ring *a* by spring *5*. Spring *5* is stronger than spring *6* and therefore holds valve member *7* open in the fuel supply line. When sleeve *4* is released, spring *6* closes off fuel supply to the engine.

3980	LEVER MECHANISM FOR PROTECTING A TURBINE AGAINST AXIAL SHIFT	LHP FD



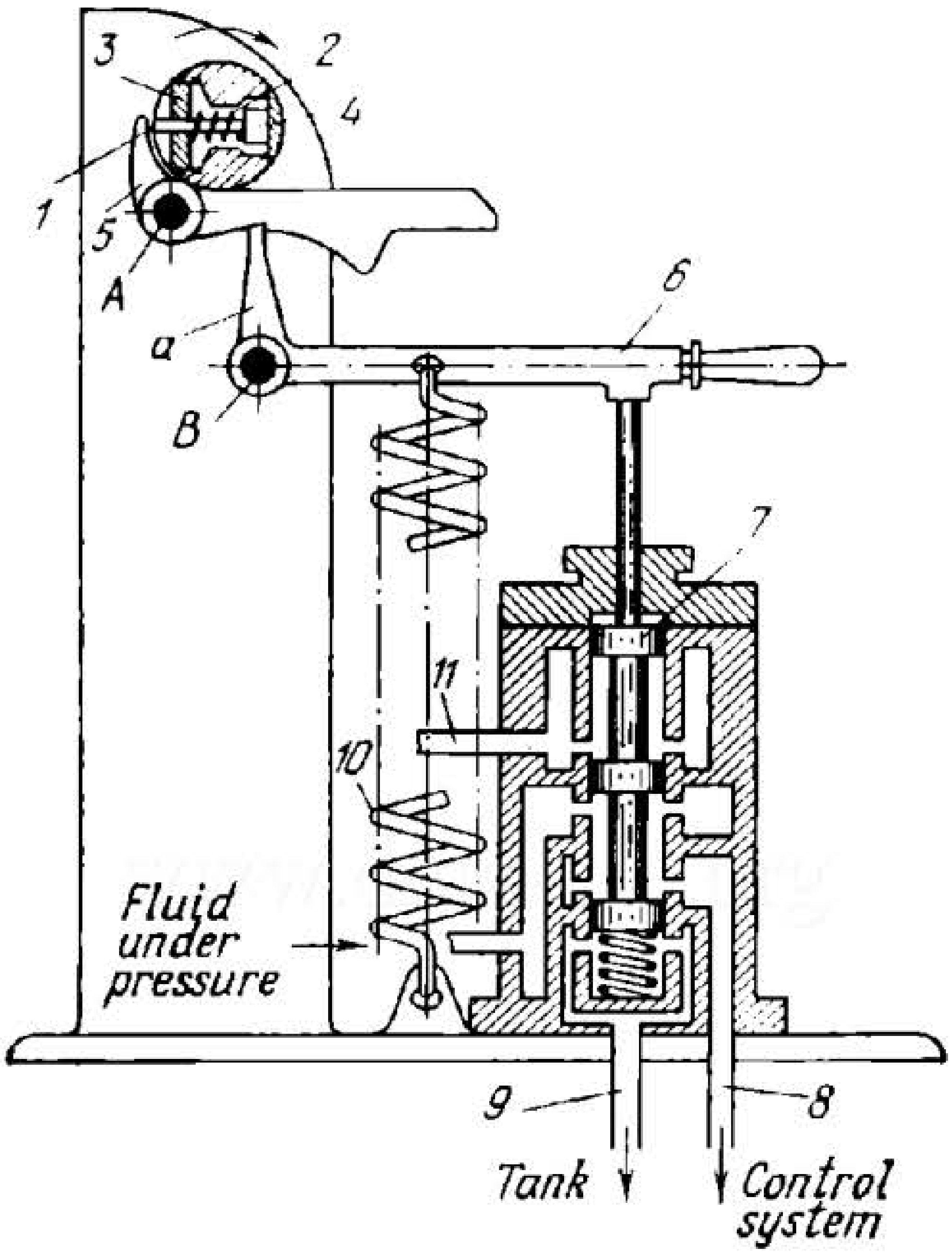
Upon axial shift of the rotor, pin *1*, actuated by spring *2*, moves together with the shaft and, by means of nut *3*, turns latch *4* about axis *C*. When the rotor shifts to the right a definite distance, latch *4* disengages valve member *6*, which is raised by spring *5*. At this, port *a* of the valve is closed and port *b* is opened, connecting the cylinder of the valve servomotor to the drain. As a result, the valve is closed and ceases to admit steam into the turbine.

3981	LEVER MECHANISM OF A TURBINE SAFETY CUTOFF	LHP FD



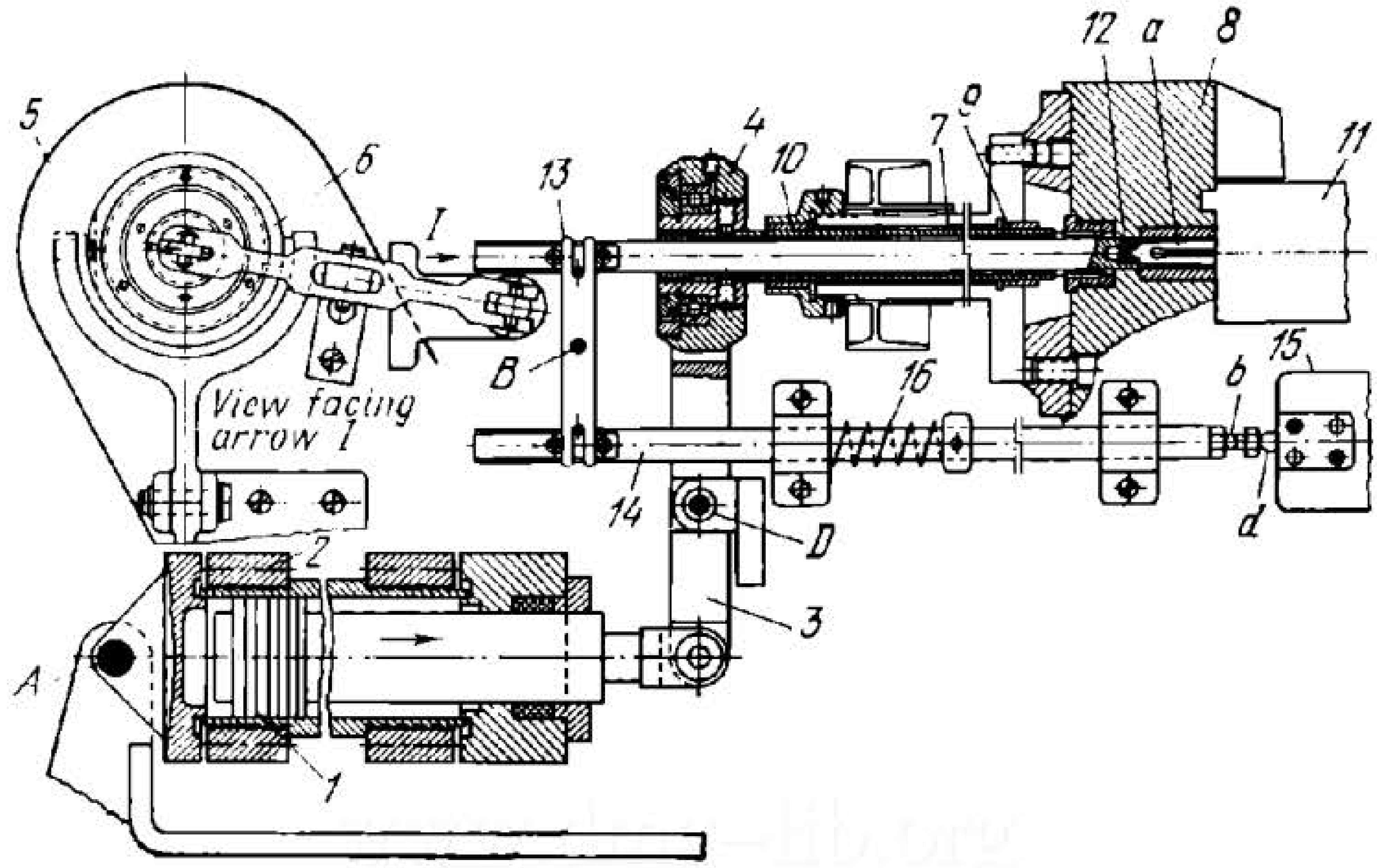
Mounted in a transverse hole of turbine shaft *1* is weight *2* whose centre of gravity does not coincide with the turbine shaft axis. Weight *2* is subject to centrifugal force and to the action of spring *3* which holds it against stop *a*. If the speed of the turbine exceeds the preset value, centrifugal force overcomes the resistance of spring *3* and weight *2* extends from shaft *1* so that it strikes lever *4*, turning it about fixed axis *A*, which releases lever *5*, turning about fixed axis *B*. Lever *5* is turned clockwise by spring *6* so that latch *7* releases sleeve *8*. Spring *9* moves sleeve *8*, together with valve member *10*, to the left, closing the valve and shutting off the steam supply to the turbine.

3982	LEVER MECHANISM OF A TURBINE SAFETY CUTOFF	LHP FD



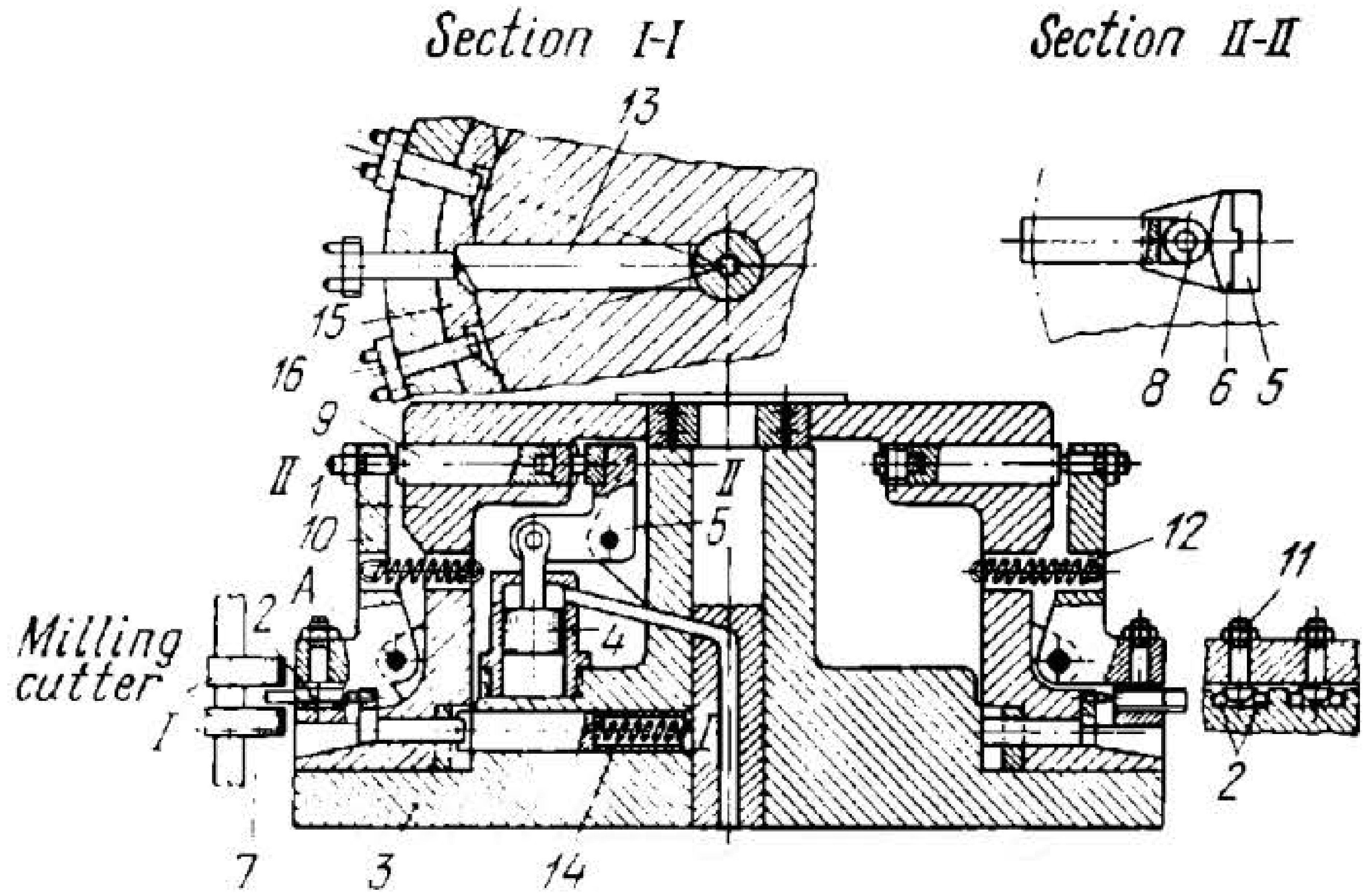
The turbine safety cutoff consists of weight *1* which, during normal operation of the turbine, is held by spring *2* and nut *3* against stop *4*. These components are arranged in a transverse hole in the main shaft of the turbine. At a speed in excess of the maximum permissible value, the weight is extended by centrifugal force so that it strikes lever *5* which turns about fixed axis *A*. This releases pawl *a* and spring *10* turns lever *6* clockwise about fixed axis *B*. At this, valve spool *7* is shifted downward. In the position shown, corresponding to normal operation, fluid is delivered under pressure by the valve into the control system through pipeline *8*. When valve member *7* shifts downward, fluid from the control system drains through the valve back to the tank along pipeline *9*. This leads to a drop in pressure in the control system, the shutoff valve rapidly closes and ceases to admit steam into the turbine. Fluid under pressure is discharged through pipeline *11*.

3983	LEVER MECHANISM OF A HYDRAULIC ATTACHMENT FOR MACHINING FROM BOTH ENDS OF THE WORKPIECE	LHP FD



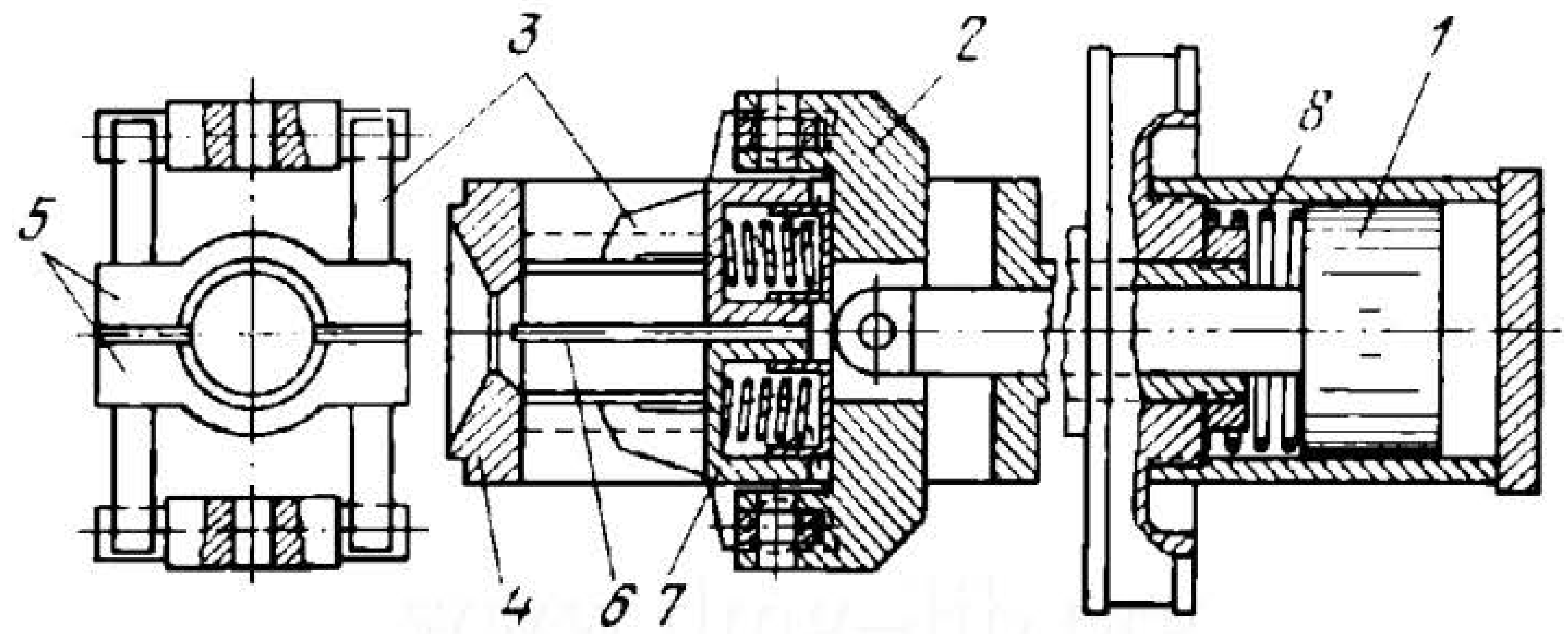
When piston *1* is moved to the right by the action of fluid delivered to the left end of cylinder *2* in which piston *1* travels, fork *3* turns about fixed axis *D*. Cylinder *2* turns about fixed axis *A*. At this, sleeve *4* is shifted to the left by trunnions *5* and blocks *6* that prevent rotation of sleeve *4*. The inner member of the sleeve is mounted on tube *7* which rotates together with the spindle and chuck *8* of the lathe. When sleeve *4* is shifted, tube *7* moves axially, sliding in bushings *9* and *10*, mounted in the spindle unit. Mounted on the right end of the spindle is jaw chuck *8* which clamps workpiece *11* when tube *7* is moved to the left. The workpiece is released in the return stroke of piston *1*. The tool for machining the rear end of the work is held in taper socket *a* of inner spindle *12* which passes through tube 7 inside the lathe spindle. Tool spindle *12* obtains its working feed from lever *13* which turns about fixed axis *B*. When lathe saddle *15* travels to the left, its stop *d* runs up against feed rod *14*. This turns fork *13* and feeds tool spindle *12* to workpiece *11*. Upon return travel of saddle *15* (to the right), tool spindle *12* is retracted to its initial position by the action of spring *16* on rod *14*. Screw *b* of rod *14* serves to adjust the length of the stroke of tool spindle *12*.

3984	LEVER MECHANISM OF A HYDRAULIC MILLING FIXTURE	LHP FD



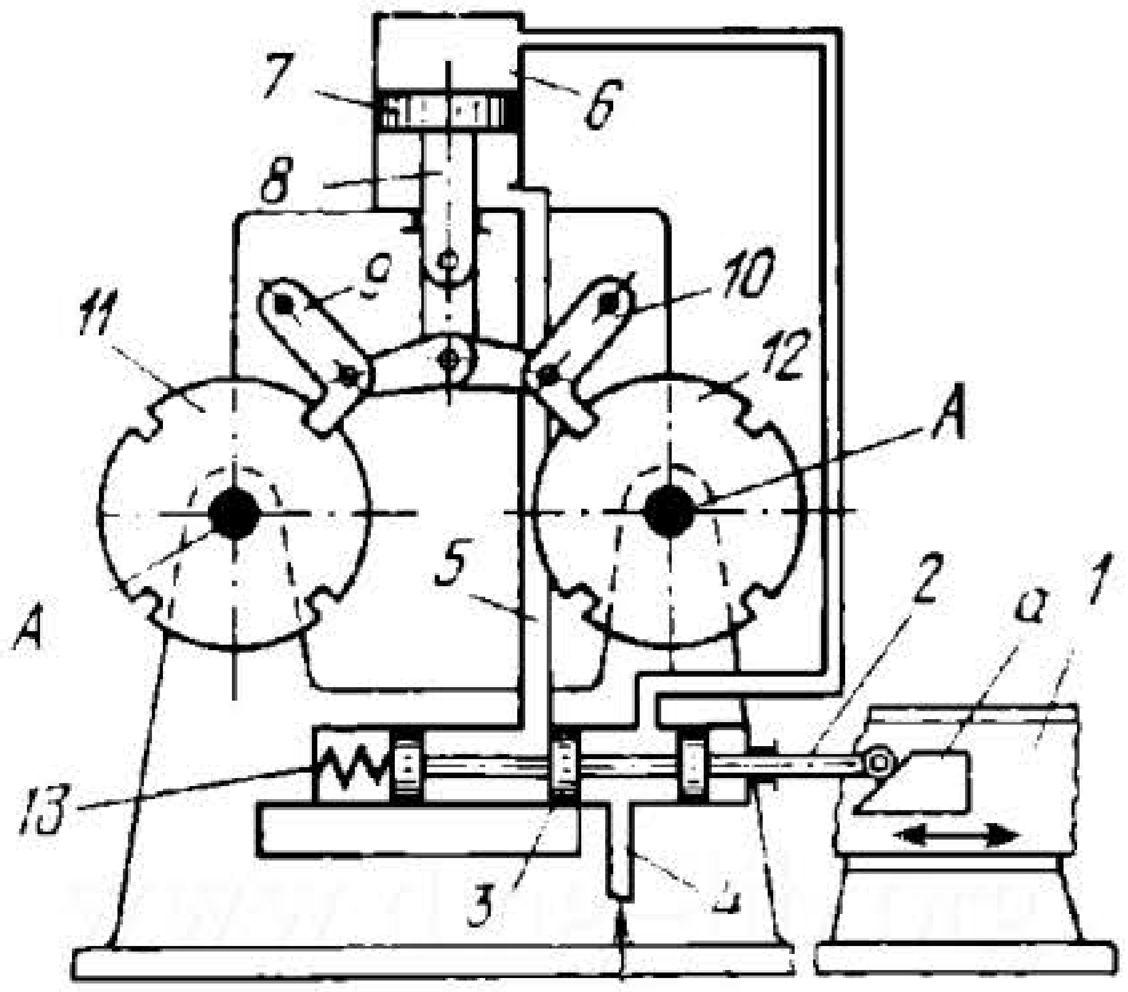
Body *1* of the fixture carries the V-blocks in which workpieces *2* are clamped and rotates with respect to stationary base *3*. Four workpieces are simultaneously loaded and clamped in each clamping section. As piston *4* is moved downward by the action of fluid delivered to the top end of its cylinder, it turns bell-crank lever *5*, to which pad *6* is secured, counter-clockwise. As a set of four workpieces approaches milling cutters *7*, roller *8* runs onto pad *6*, pushing pin *9* outward and turning lever *10* about axis *A*. This clamps the workpieces by means of two self-adjusting wedge-head pins *11*. The clamping action continues during the time the four workpieces are being milled. When the workpieces leave the milling cutters, roller *8* runs off pad *6*, spring *12* pulls lever *10* toward the centre and the workpieces are released. Then pin *13* is disengaged by spring *14* from a tooth of internal ratchet wheel *15*, striking ejector *16* which ejects the milled workpieces out of the fixture.

3985	LEVER MECHANISM FOR A BEARING-CAP CLAMPING FIXTURE	LHP FD



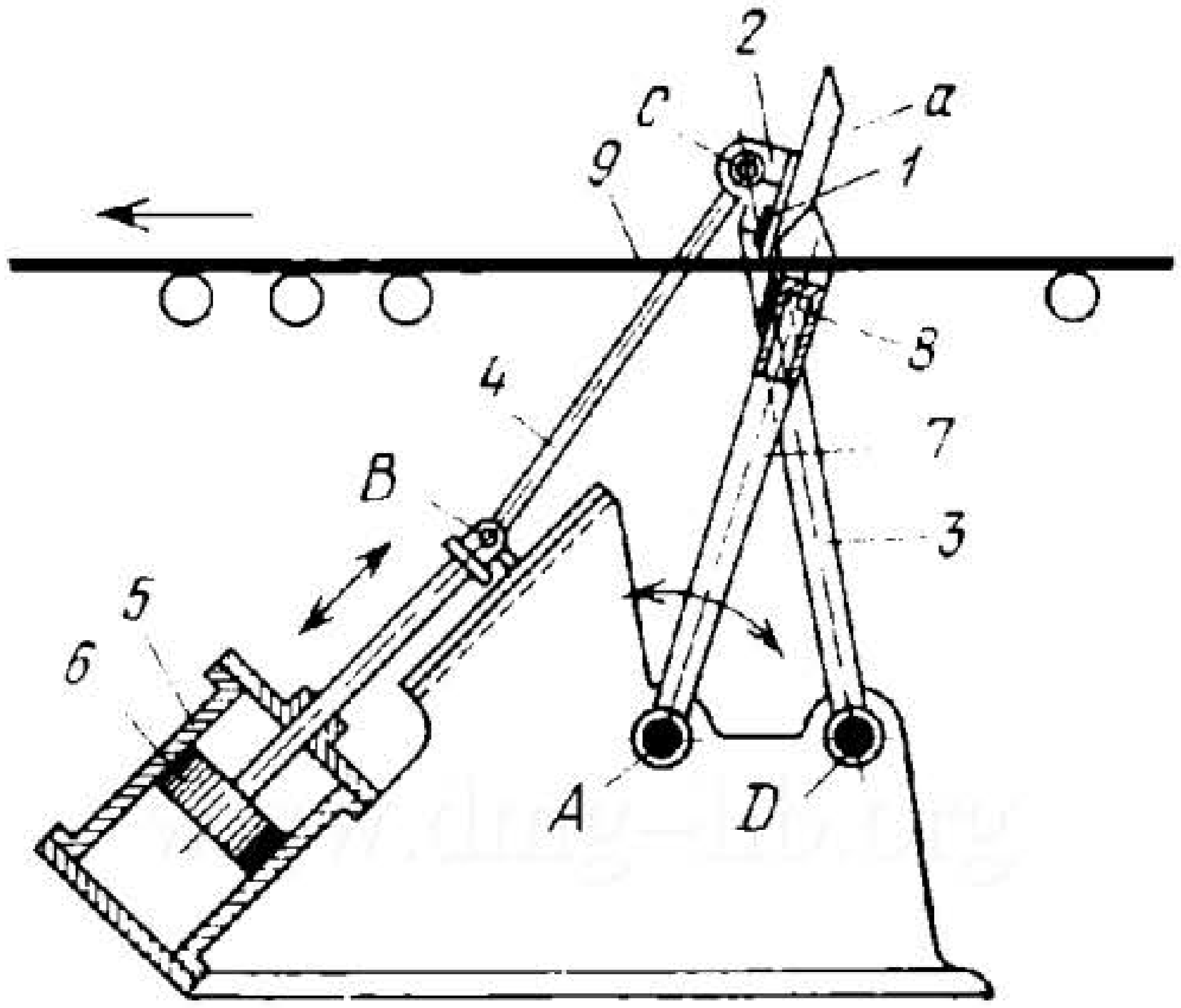
When piston 1 is moved to the left by the action of fluid delivered to the right end of its cylinder, motion is transmitted through crosspiece 2 to four levers 3. As the levers turn, they clamp bearing caps 5 against plate 6 which also serves to locate the caps radially. At the same time, two spring-loaded plungers 7 hold the end faces of the caps against body 4 of the fixture. The caps are released when piston 1 is moved to the right by spring 8.

3986	LEVER-TYPE INDEXING MECHANISM	LHP FD



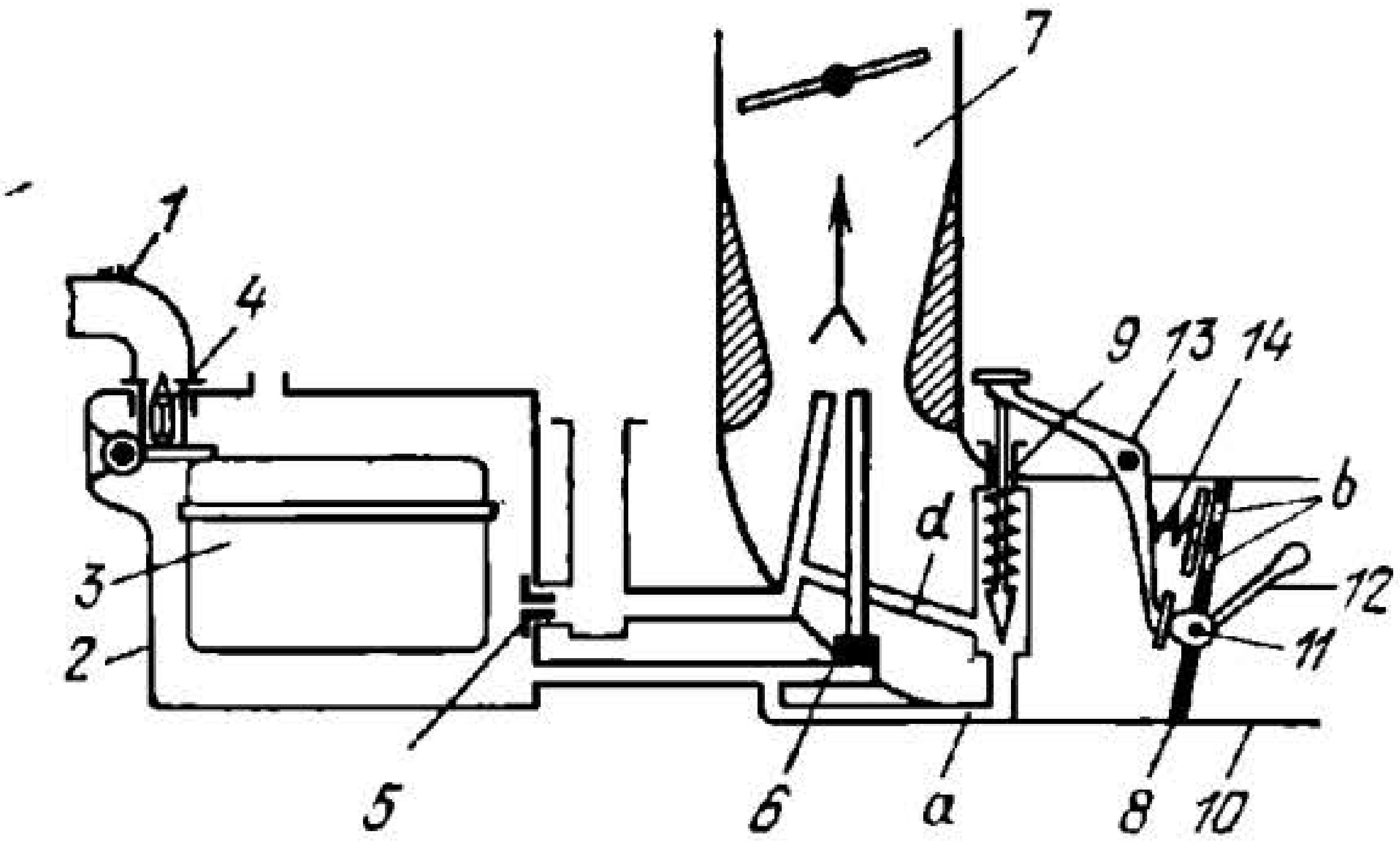
As machine table *1* travels to the left, stop *a* shifts stem *2* of valve spool *3* so that fluid, delivered through pipeline *4*, is directed through pipeline *5* to the bottom end of cylinder *6*, raising piston *7*. This turns identical and symmetrically arranged pawls *9* and *10*, linked to piston rod *8*, about fixed axes, disengaging them from two identical index disks *11* and *12* which are turned about fixed axes *A* through one division by a driving device (not shown). At the same time, table *1* begins to travel to the right, stop *a* releases stem 2 and valve spool *3* is shifted to the right by spring *13*. This directs fluid to the top end of cylinder *6* and pawls *9* and *10* drop into the next slots of disks *11* and *12*, holding them against rotation until the indexing operation is repeated in the next stroke of table *1*.

3987	LEVER MECHANISM OF A FLYING SHEAR	LHP FD



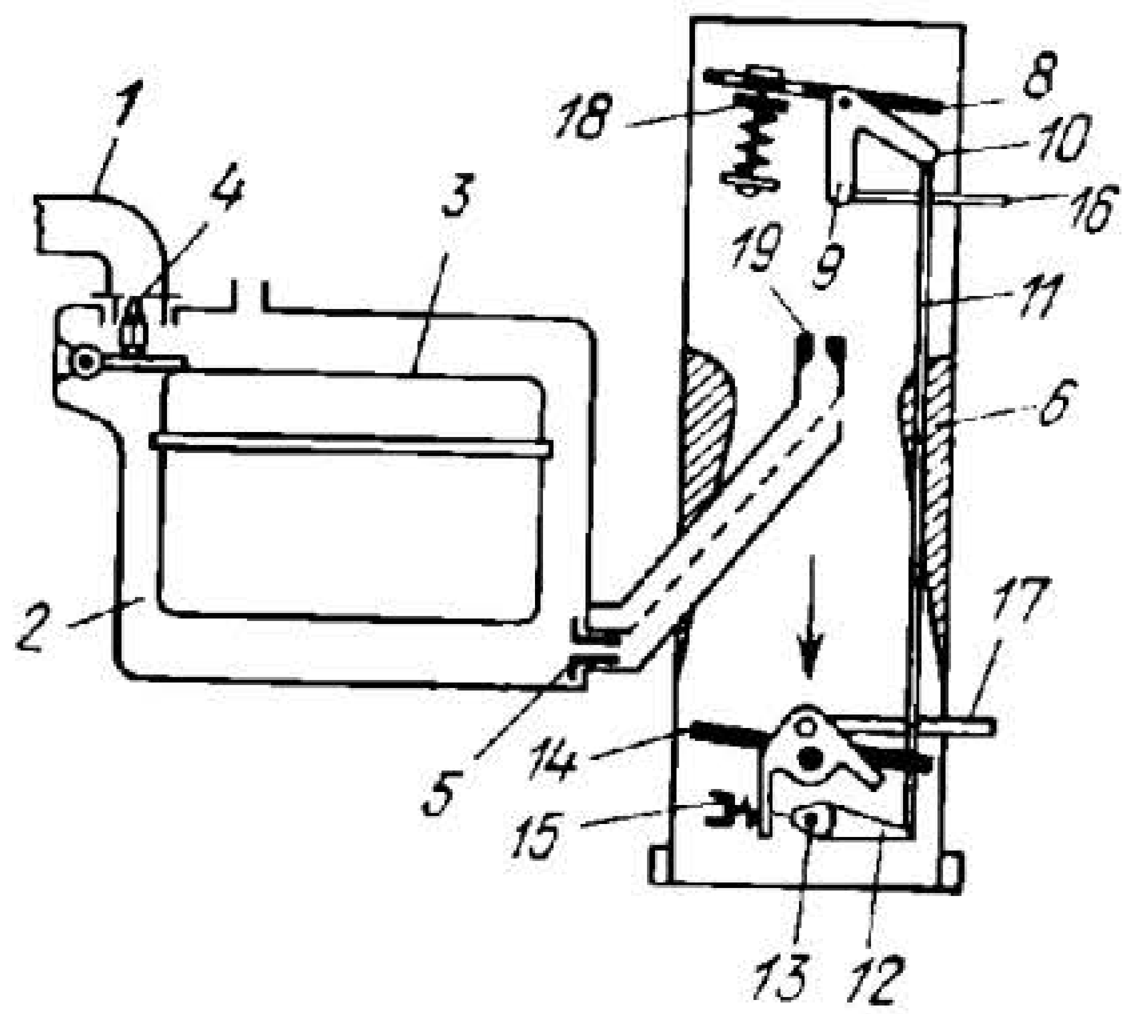
Upper blade *1* is mounted on slider *2* which reciprocates in guides *a* of frame *7*. Frame *7* turns about fixed axis *A*. Slider *2* is driven by piston *6* which reciprocates in stationary steam cylinder *5* and is connected by turning pair *B* to connecting rod *4*. Connecting rod *4* is connected by turning pair *C* to slider *2*. Rocker arm *3*, turning about fixed axis *D*, is connected by turning pair *C* to connecting rod *4*. In shearing stock *9*, piston *6* of steam cylinder *5* moves downward, frame *7* turns in the direction of the moving stock and blades *1* and *8* make the cut. Lower blade *8* is secured rigidly to oscillating frame *7*.

3988	LEVER-CAM MECHANISM OF AN AUTOMOBILE ENGINE STARTING DEVICE	LHP FD



Fuel is delivered through pipe *1* into chamber *2*, which contains float *3* operating needle valve *4*. From the float chamber, the fuel passes through metering orifices *5* and *6* into the narrow end of venturi *7* where the fuel-air mixture is formed. At the moment of starting, the fuel-air mixture must be enriched. This is accomplished by the provision of choke *8* in air supply pipe *10* and additional needle valve *9*. Rigidly mounted on the shaft of choke *8* is cam *11* which is rigidly attached to control lever *12*. In starting, lever *12* is turned to close choke *8*, cam *11* turns lever *13* to raise needle valve *9*. This enriches the fuel-air mixture because additional fuel is admitted into venturi *7* through valve *9* and passages *a* and *d*. Automatic valve *14* is mounted on choke *8*. As soon as the engine starts running, the vacuum acting on the choke is sharply increased and valve *14* is withdrawn from the choke, opening holes *b* in the choke. This admits additional air into the venturi and cuts down enrichment of the mixture. As the engine heats up, the choke is gradually opened, closing needle valve *9* and leaning the fuel-air mixture.

3989	LEVER MECHANISM OF AN AUTOMOBILE ENGINE STARTING DEVICE	LHP FD



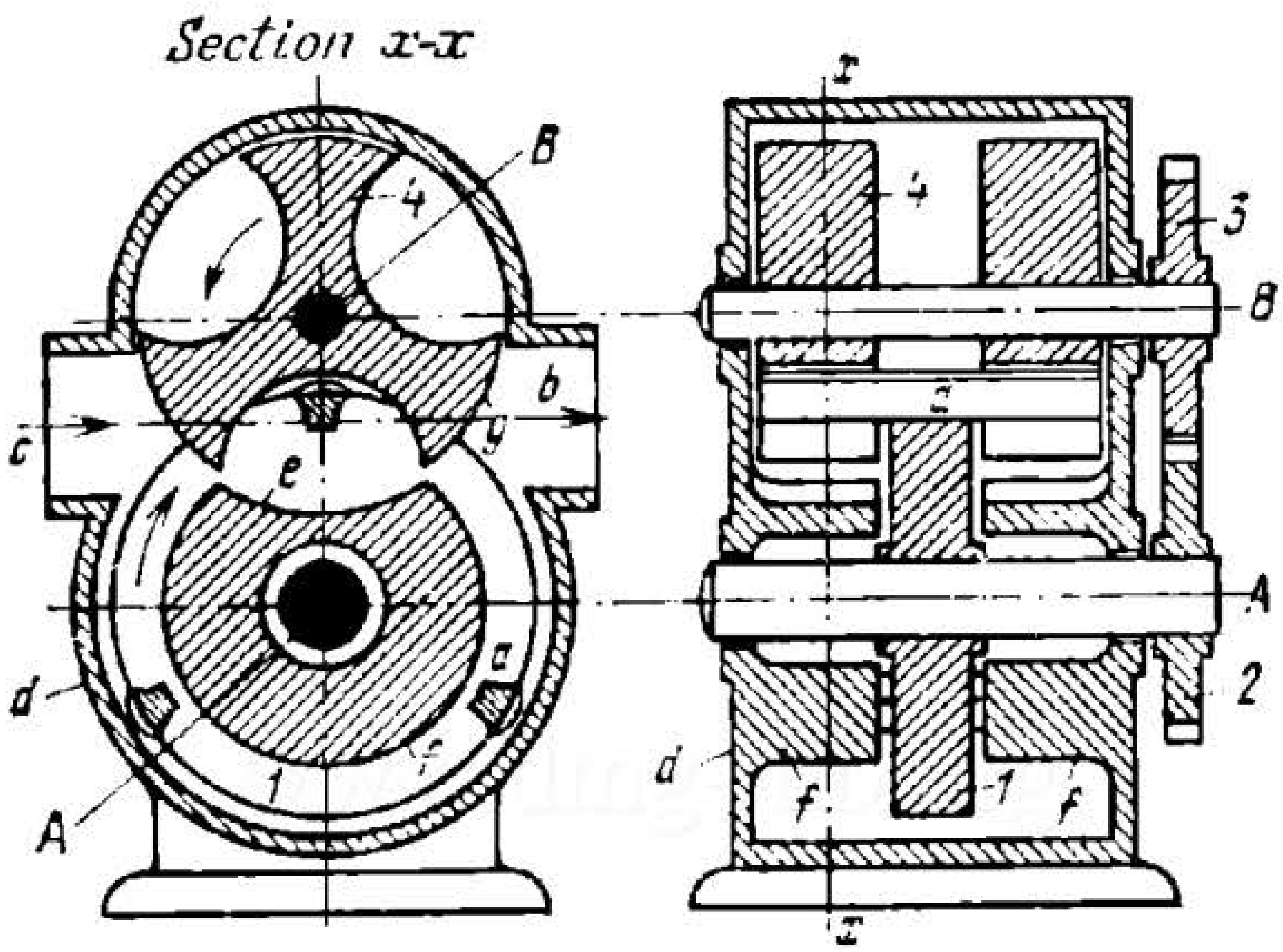
Fuel is delivered through pipe *1* into chamber *2* which contains float *3* operating needle valve *4*. From the float chamber, the fuel passes through metering orifice *5* into the narrow end of venturi *6* where it is mixed with air entering at increased pressure through metering orifice *19*. The mixture strength can be varied by varying the relative positions of the throttle valve and choke. Rigidly mounted on the choke shaft are levers *9* and *10* which are attached to each other. Lever *9* is the control lever. Lever *10* is linked by tie-rod *11* to lever *12* which is rigidly secured to cam *13*. The position of throttle valve *14* depends upon the setting of screw *15* which contacts cam *13*. In starting, choke *8* is closed by means of tie-rod *16*, turning lever *10* counterclockwise so that tie-rod *11* turns cam *13*. This slightly opens throttle valve *14*. As soon as the engine starts running, the vacuum behind the choke is sharply increased and valve *18* is withdrawn from the choke, opening holes provided in the choke. This admits additional air into the venturi and cuts down enrichment of the mixture. As the engine heats up the throttle valve is gradually opened. This can be done by means of tie-rod *17*.

SECTION THIRTY

Toothed Hydraulic and Pneumatic Mechanisms THP

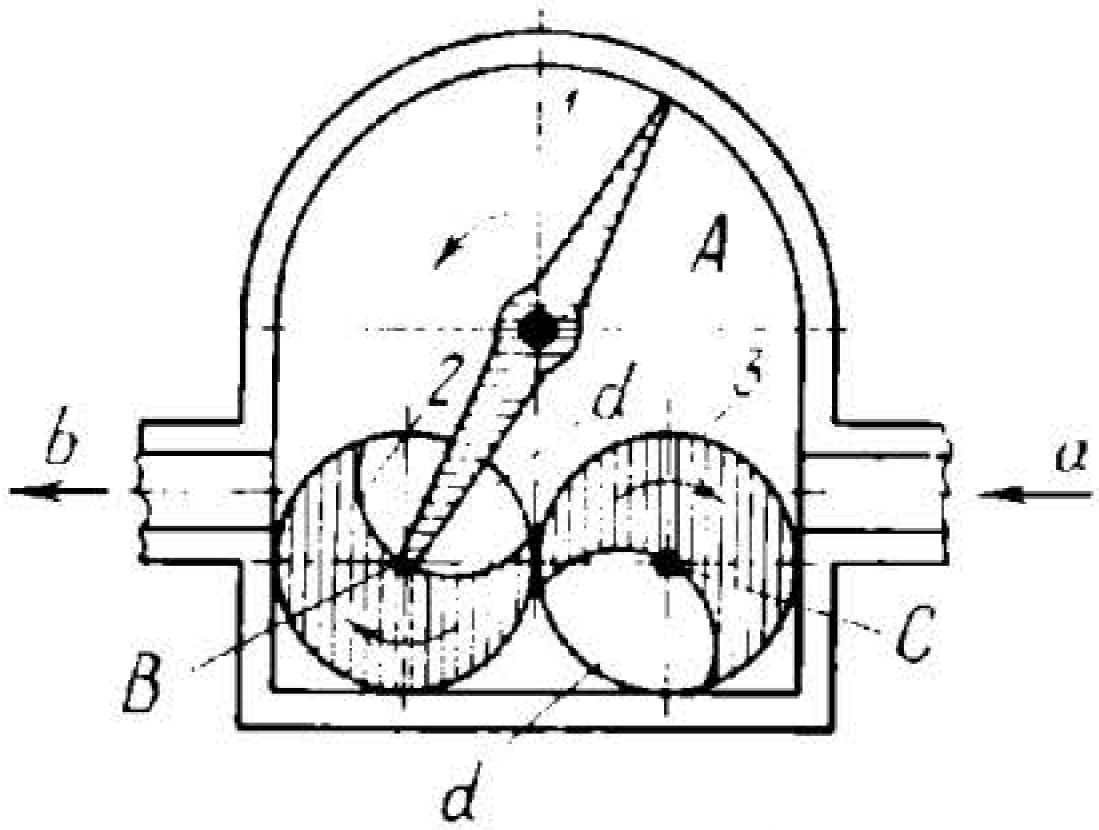
1. ROTARY VANE AND PISTON PUMP MECHANISMS (3990 and 3991)

3990	VANE PUMP MECHANISM	THP RP



Disk *1* rotates about fixed axis *A* and has vanes *a*. Stationary cylinder *f* is rigidly attached to housing *d* and has circular recess *e*. Upon rotation of disk *1*, vanes *a* continuously move the fluid in the direction of arrows *c* and *b*. The suction and discharge chambers are separated by the entry of teeth *g* of rotor *4*, rotating about fixed axis *B*, into recess *e*. Disk *1* and rotor *4* are driven by meshing gears *2* and *3*, with the same number of teeth, which are keyed on shafts together with disk *1* and rotor *4*.

3991	VANE-TYPE AIR BLOWER MECHANISM WITH DISTRIBUTOR ROTORS	THP RP



Vane 1 rotates about fixed axis A. Two identical distributor rotors, 2 and 3, rotate about fixed axes B and C, and have circular recesses d. Upon rotation of vane 1, air is continuously moved in the direction of arrows a and b. Rotors 2 and 3 serve to separate the suction and discharge chambers. Vane 1 and rotors 2 and 3 are driven by meshing gears with the transmission ratios

$$i_{12}=\frac{\omega_1}{\omega_2}=\frac{n_1}{n_2}=\frac{1}{2}$$

and

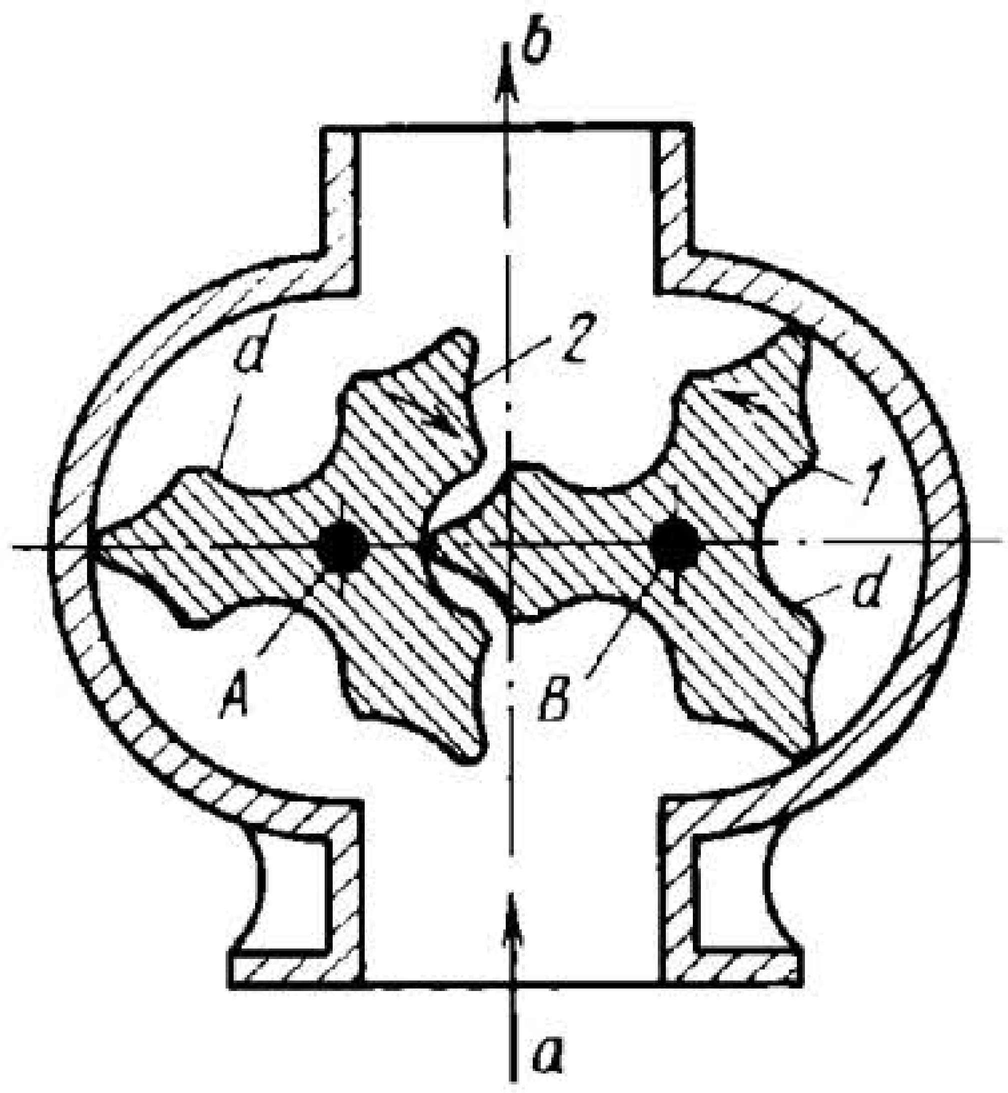
$$i_{23}=\frac{\omega_2}{\omega_3}=\frac{n_2}{n_3}=-1$$

where ω_1, ω_2, ω_3, n_1, n_2 and n_3 are the angular velocities and speeds of vane 1 and rotors 2 and 3.

2. GEAR AND OTHER ROTARY PUMP MECHANISMS
(3992 through 4015)

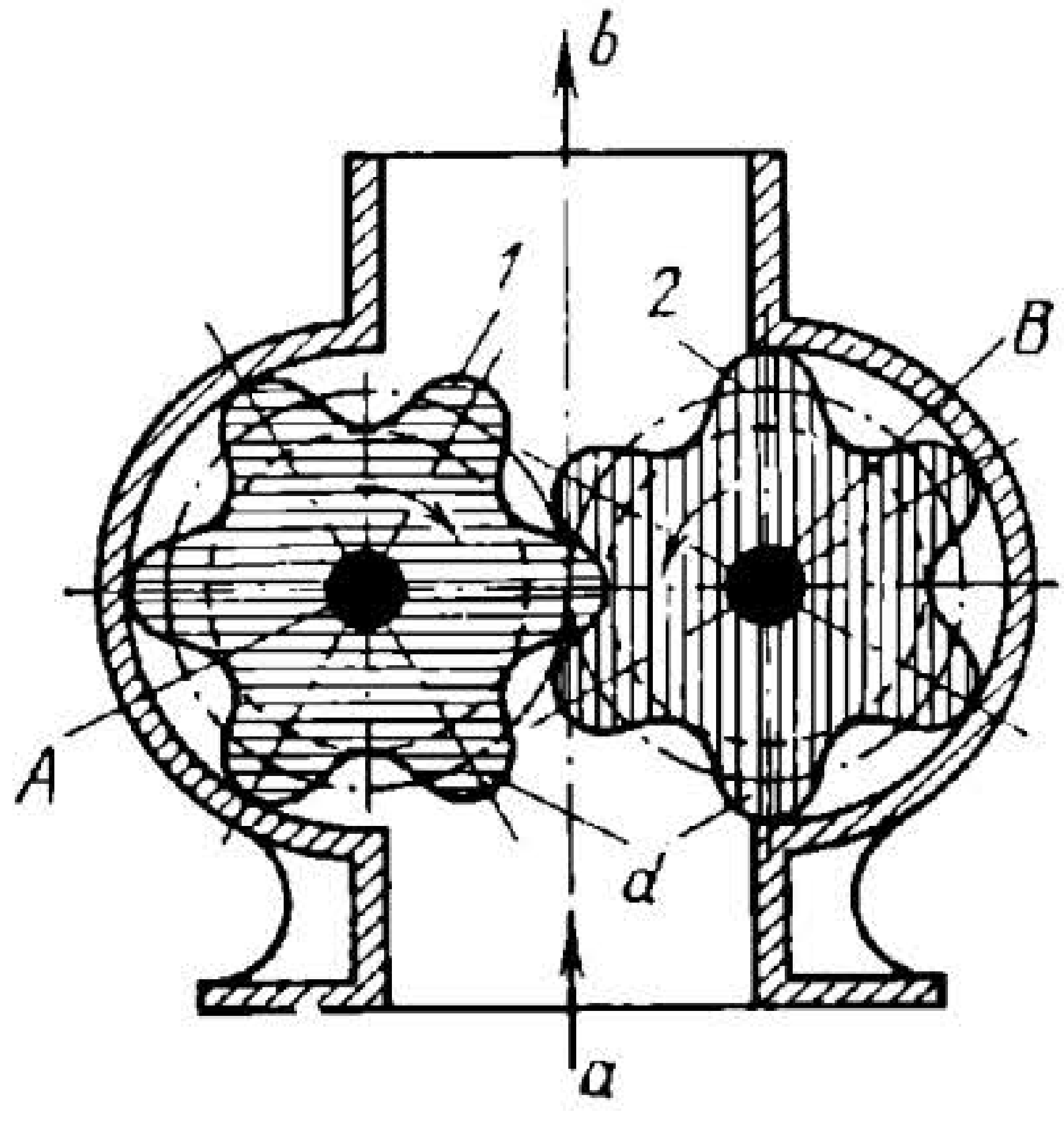
3992	ROTARY GEAR PUMP MECHANISM	THP GP

Impellers 1 and 2 rotate about fixed axes B and A and each has three identical teeth d whose profile is made up of portions of cycle curves. When impellers 1 and 2 rotate, fluid is delivered continuously in the direction of arrows a and b. The suction and discharge chambers are separated by imparting a special profile to teeth d of impellers 1 and 2. The impellers are driven by two meshing identical gears keyed on shafts with impellers 1 and 2.

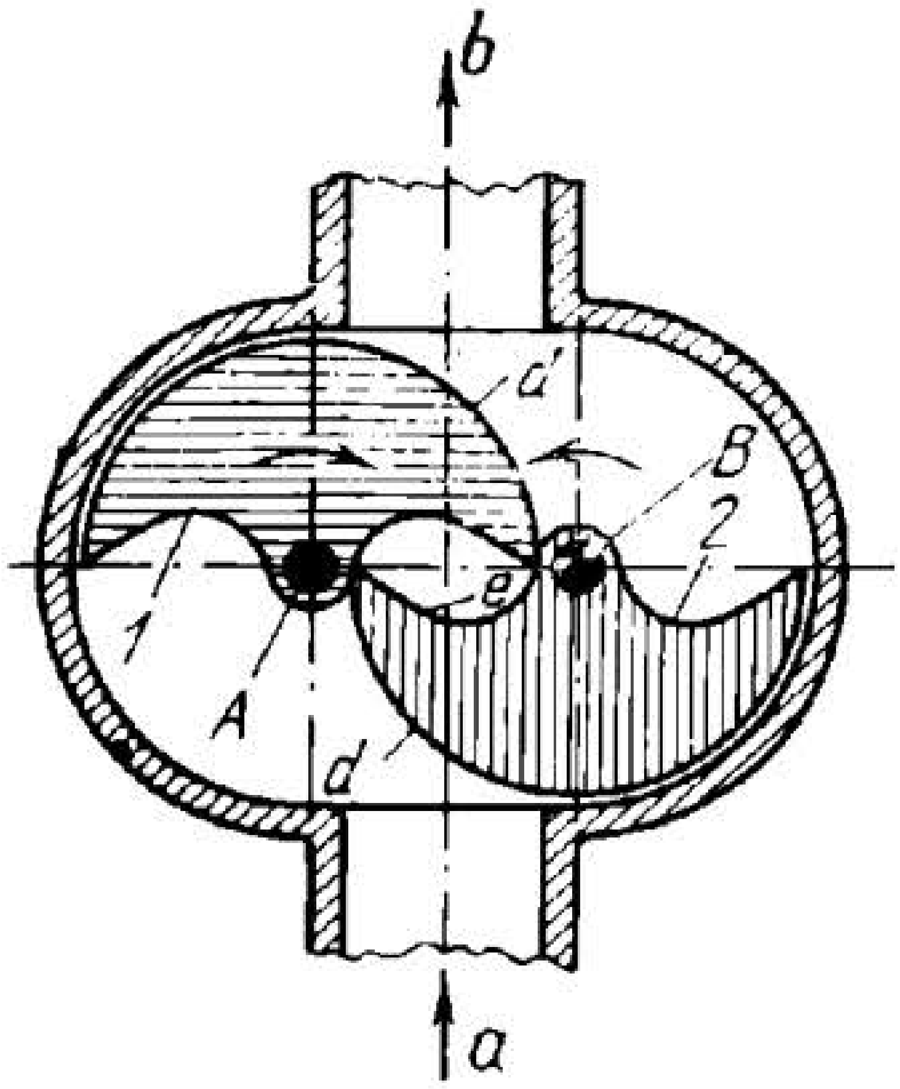


3993	ROTARY GEAR PUMP MECHANISM	THP GP

Impellers 1 and 2 rotate about fixed axes A and B and each has six identical teeth d whose profile is made up of portions of cycle curves. When impellers 1 and 2 rotate, fluid is delivered continuously in the direction of arrows a and b. The suction and discharge chambers are separated by imparting a special profile to teeth d of impellers 1 and 2. The impellers are driven by two meshing identical gears keyed on shafts with impellers 1 and 2.

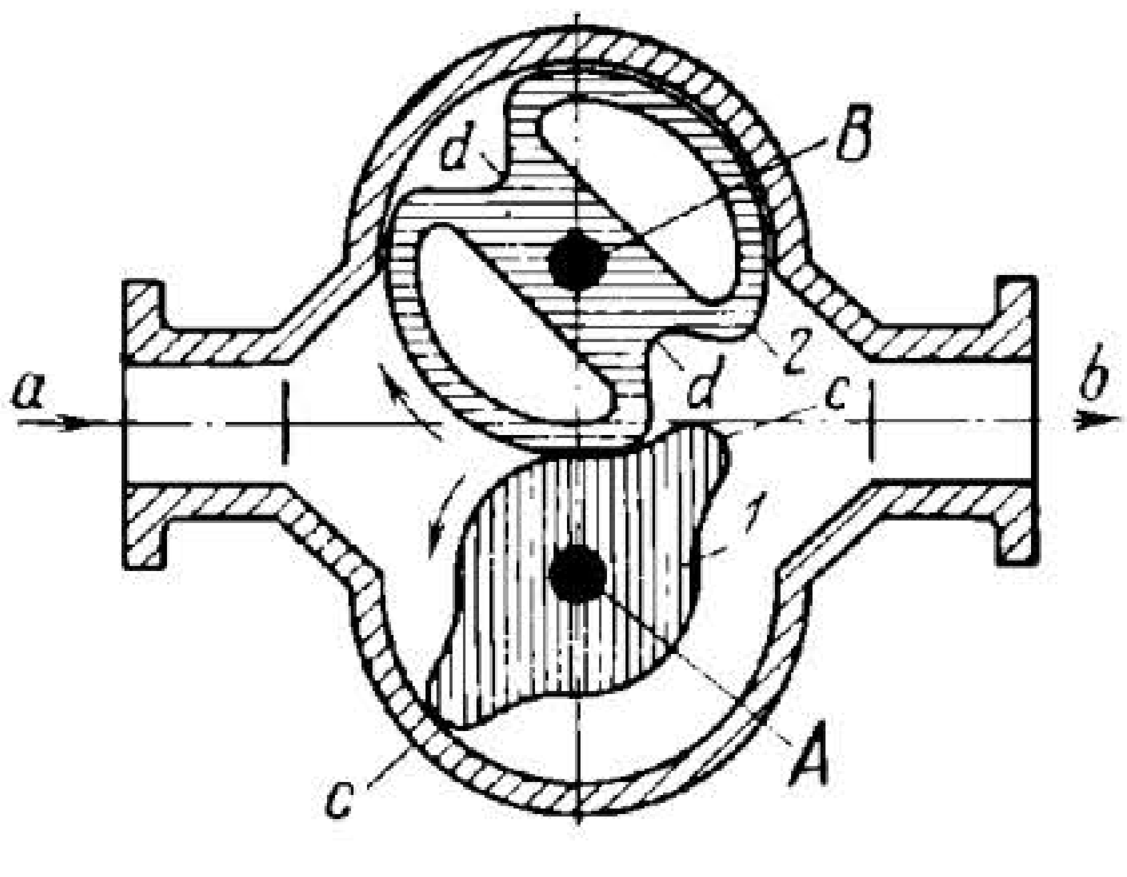


3994	ROTARY GEAR PUMP MECHANISM	THP GP



Two identical impellers, *1* and *2*, rotate about fixed axes *A* and *B* and have the shape of semi-disks *d* with recesses *e* whose profile is made up of portions of cycle curves. When impellers *1* and *2* rotate, fluid is delivered continuously in the direction of arrows *a* and *b*. The suction and discharge chambers are separated by imparting a special profile to recesses *e*. The impellers are driven by two meshing identical gears keyed on shafts with impellers *1* and *2*.

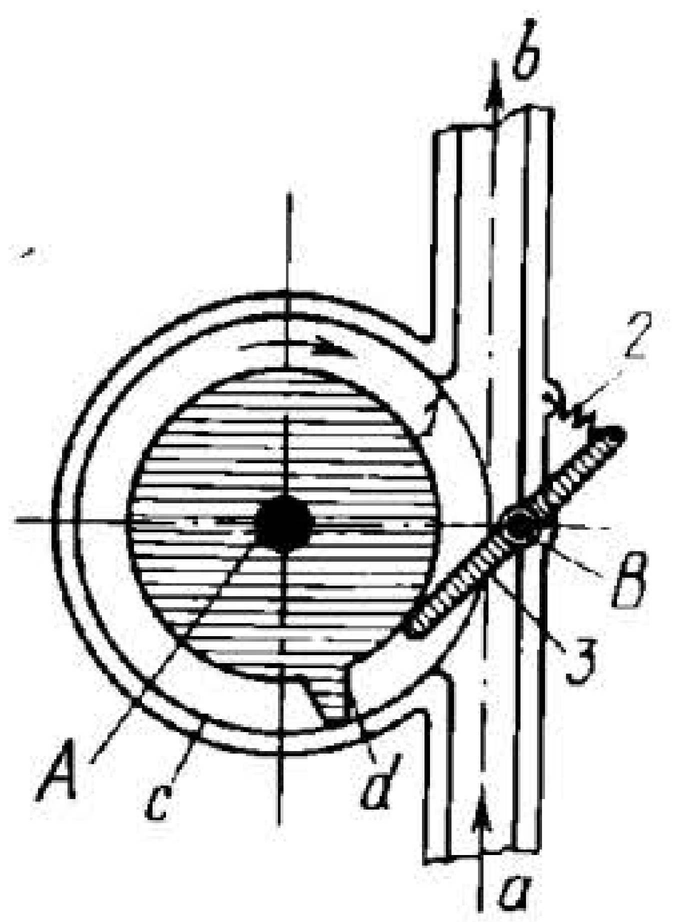
3995	ROTARY GEAR PUMP MECHANISM	THP GP



Impellers *1* and *2* rotate about fixed axes *A* and *B*. Teeth *c* of impeller *1* engage tooth spaces *d* of impeller *2*. The profiles of teeth *c* and tooth spaces *d* are made up of portions of cycle curves. When impellers *1* and *2* rotate, fluid is delivered continuously in the direction of arrows *a* and *b*. The suction and discharge chambers are separated by imparting special profiles to teeth *c* and tooth spaces *d*. The impellers are driven by two meshing identical gears keyed on shafts with impellers *1* and *2*.

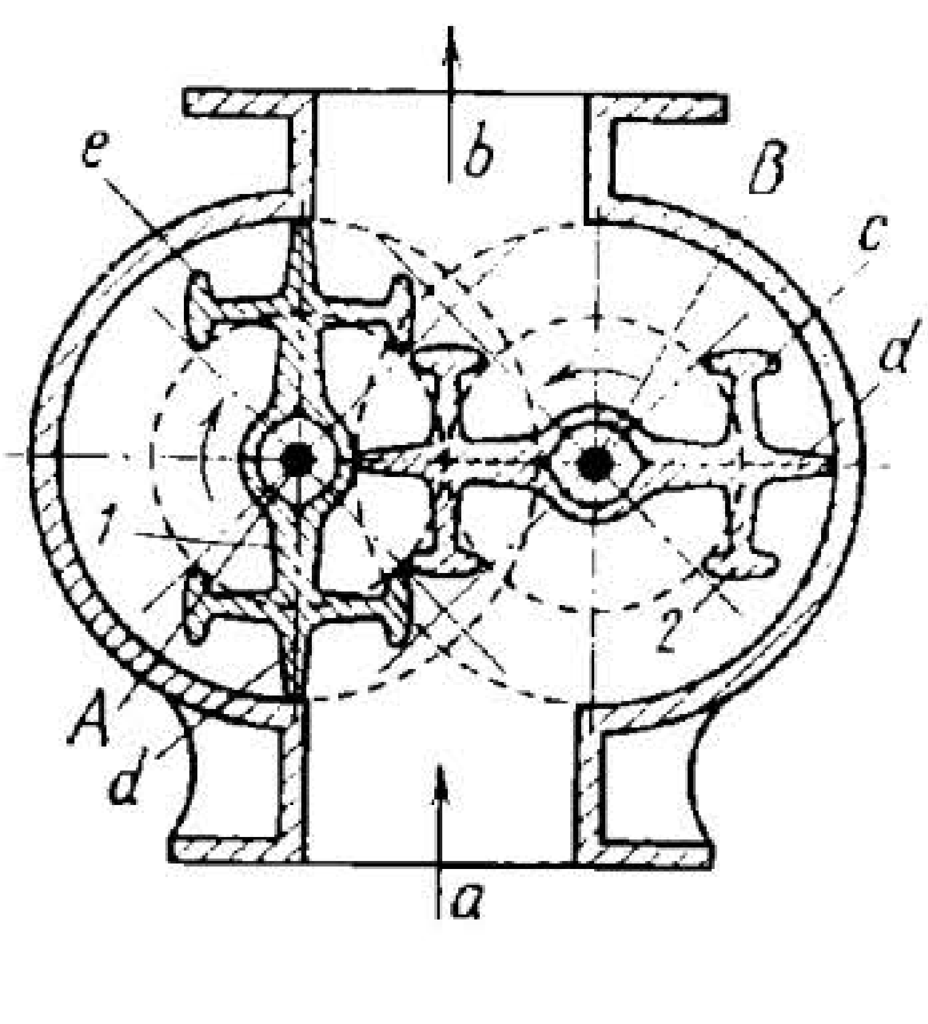
3996	HINGED-ABUTMENT SINGLE-TOOTH ROTARY PUMP MECHANISM	THP GP

Impeller 1 rotates about fixed axis A and has tooth d. When impeller 1 rotates, the tip of tooth d slides along the circular inside surface c of the housing and continuously delivers fluid in the direction of arrows a and b. The suction and discharge chambers are separated by lever-type hinged abutment 3, turning about fixed axis B and held to the impeller by spring 2.

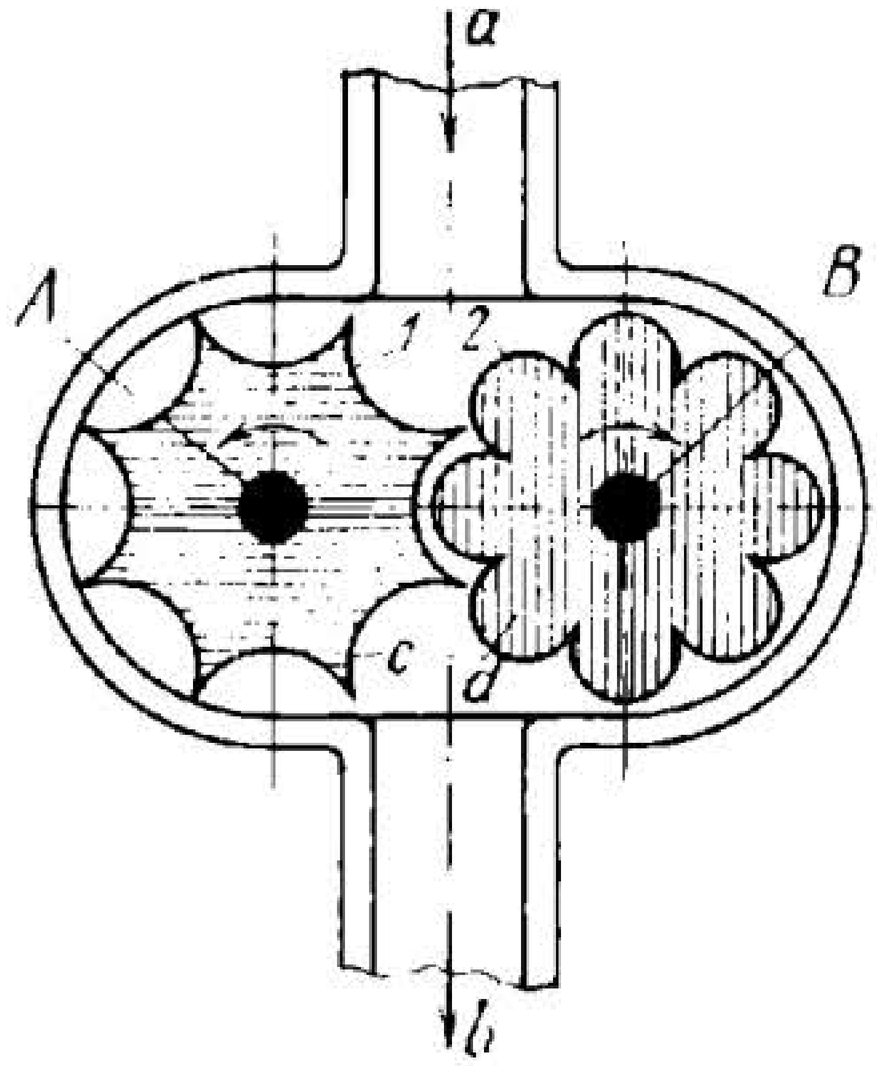


3997	ROTARY GEAR PUMP MECHANISM	THP GP

Impellers 1 and 2 rotate about fixed axes A and B and have symmetrically arranged pin-shaped teeth d and mushroom-shaped teeth e. When impellers 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting special profiles to teeth d and e. The impellers are driven by two meshing identical gears keyed to the shafts of impellers 1 and 2.

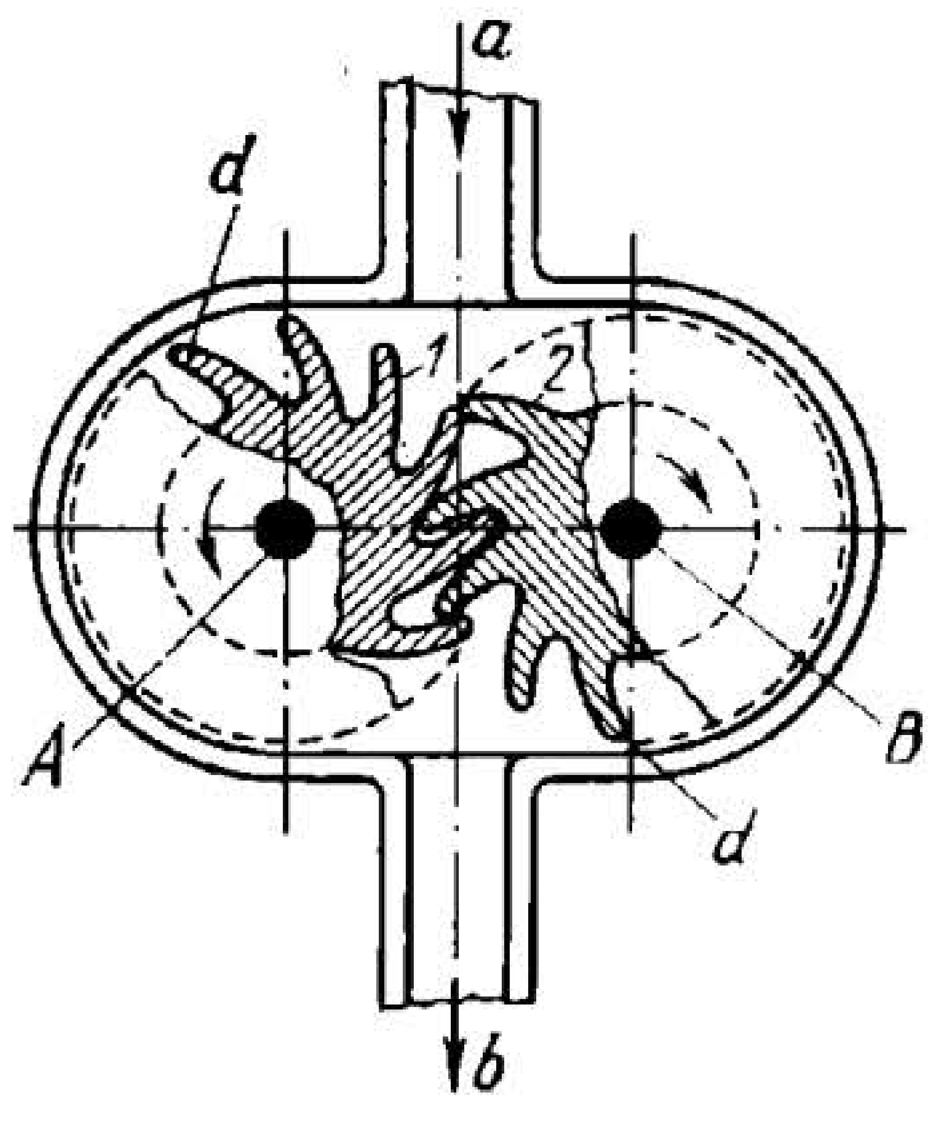


3998	ROTARY GEAR PUMP MECHANISM	THP GP



Impellers 1 and 2 rotate about fixed axes A and B and have teeth c and d whose profiles are made up of portions of cycle curves. When impellers 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting special profiles to teeth c and d of impellers 1 and 2. The impellers are driven by two meshing identical gears keyed to the shafts of impellers 1 and 2.

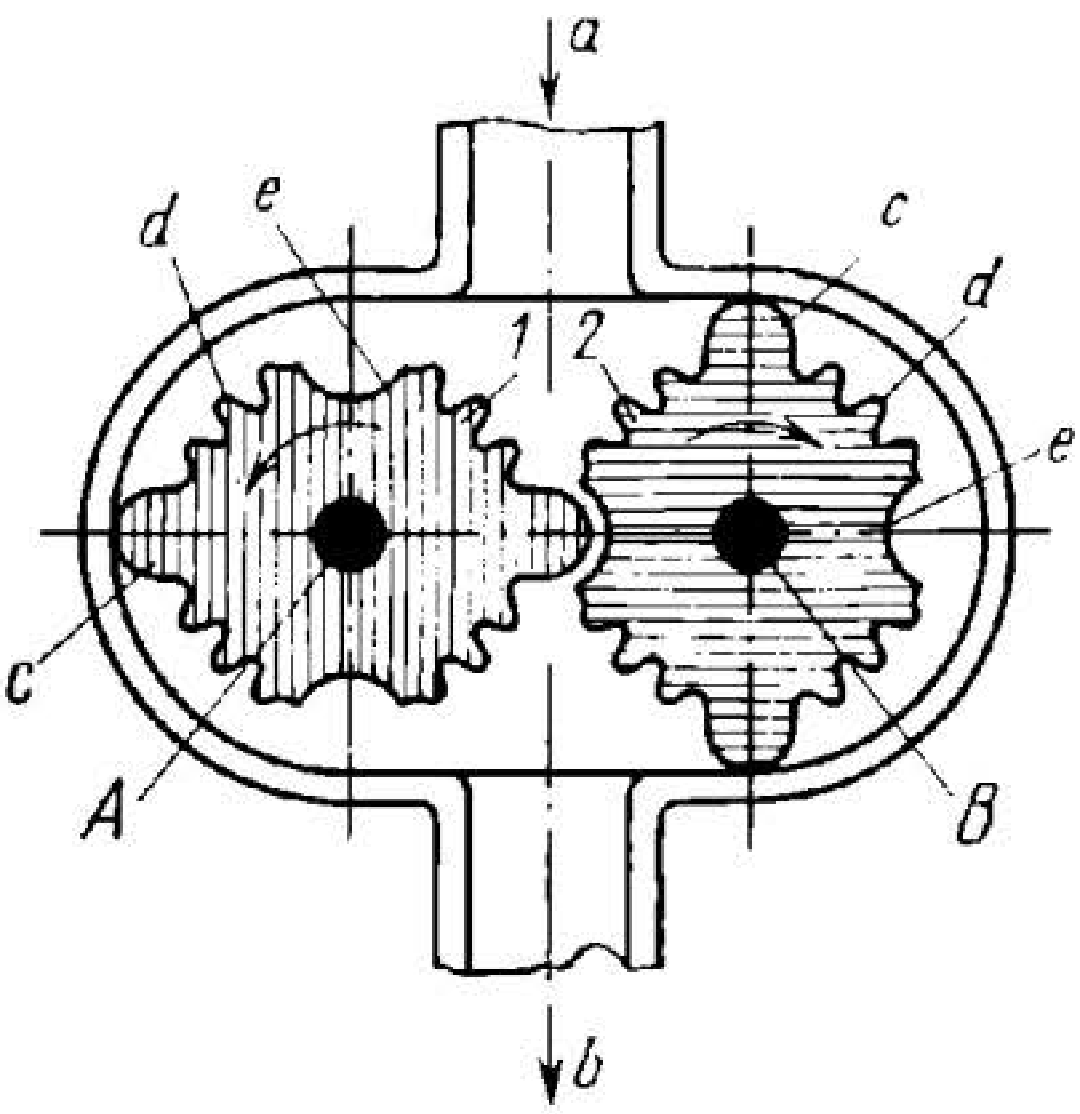
3999	ROTARY GEAR PUMP MECHANISM	THP GP



Impellers 1 and 2 rotate about fixed axes A and B and have identical finger-shaped teeth d whose profile is made up of portions of cycle curves. When impellers 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting a special profile to teeth d. The impellers are driven by two meshing identical gears keyed to the shafts of impellers 1 and 2.

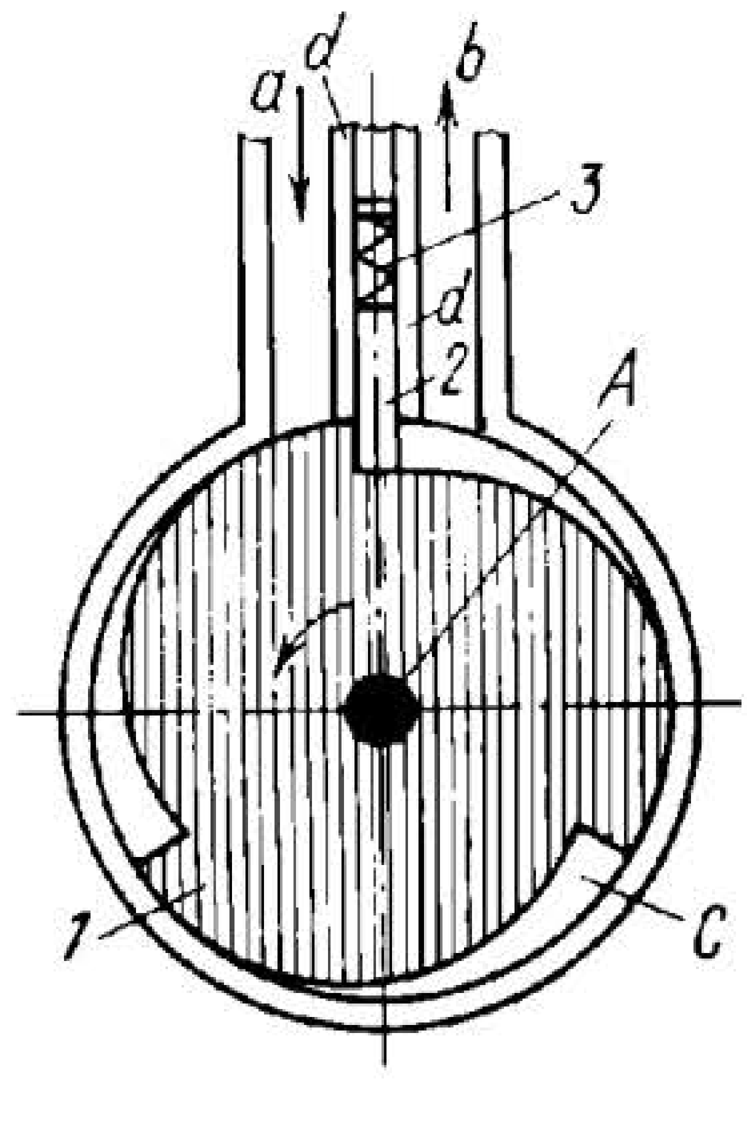
4000	ROTARY GEAR PUMP MECHANISM	THP GP

Impellers *1* and *2* rotate about fixed axes *A* and *B* and have symmetrically arranged teeth *c* and *d* and tooth spaces *e*. When impellers *1* and *2* rotate, fluid is continuously delivered in the direction of arrows *a* and *b*. The suction and discharge chambers are separated by imparting special profiles to teeth *c* and *d* and to tooth spaces *e* of the impellers. The impellers are driven by two meshing identical gears keyed to the shafts of impellers *1* and *2*.

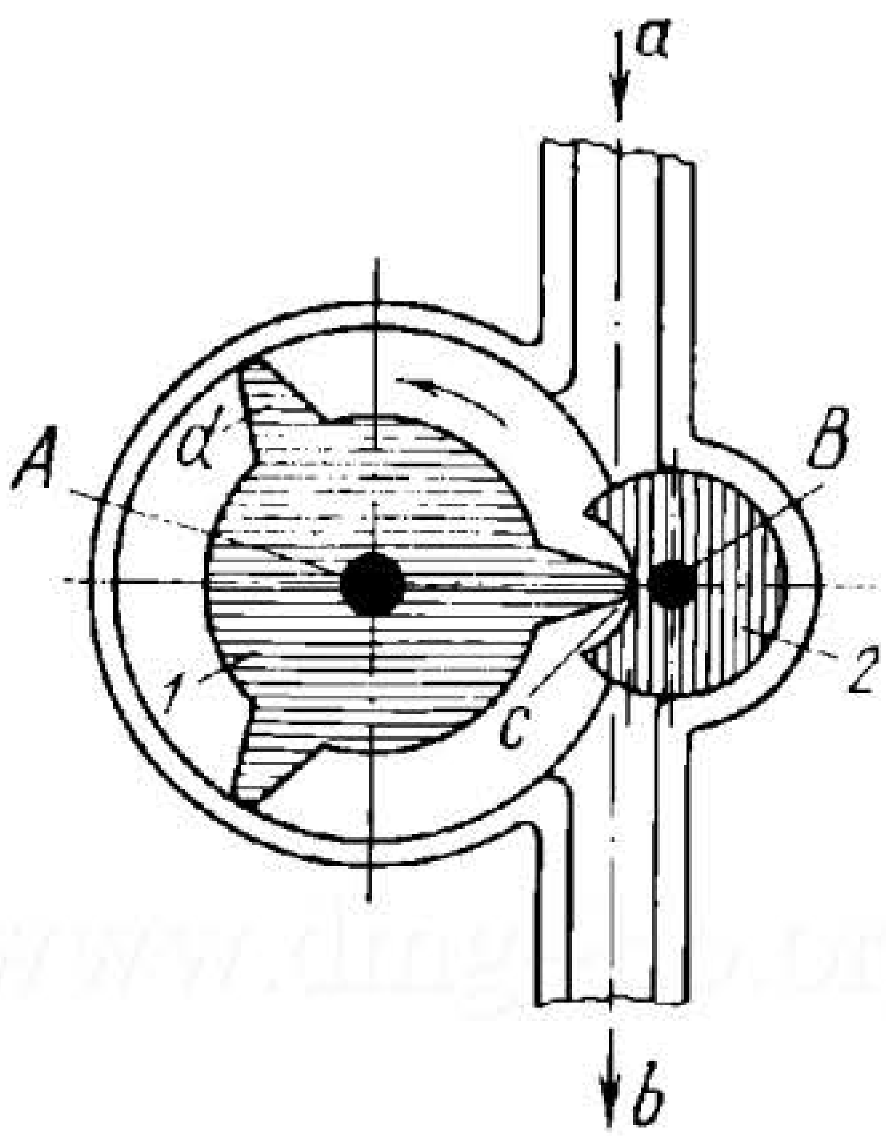


4001	SLIDING-ABUTMENT THREE-TOOTH ROTARY PUMP MECHANISM	THP GP

Impeller *1* rotates about fixed axis *A* and has three tooth spaces *c*. Flat abutment *2* slides in fixed guides *d* and is held in contact with impeller *1* by spring *3*. Abutment *2* separates the suction and discharge chambers. When impeller *1* rotates, fluid is continuously delivered in the direction of arrows *a* and *b*.



4002	THREE-TOOTH ROTARY PUMP MECHANISM WITH A DISTRIBUTOR ROTOR	THP GP



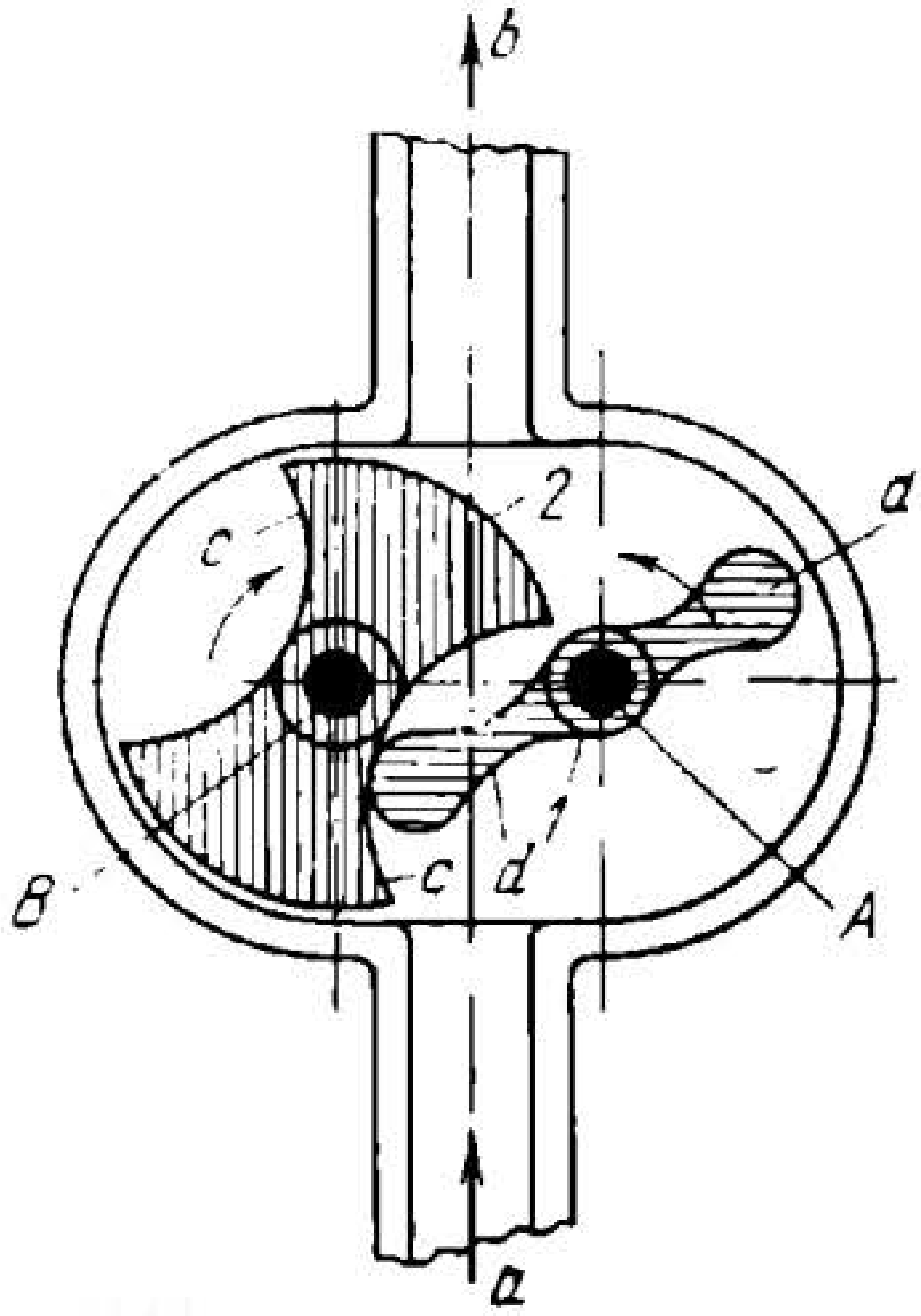
Impeller 1 rotates about fixed axis A and has three teeth d. Distributor rotor 2 rotates about fixed axis B and has circular recess c. Rotor 2 serves to separate the suction and discharge chambers. Upon rotation of impeller 1, fluid is continuously delivered in the direction of arrows a and b. Impeller 1 and rotor 2 are driven by two meshing gears keyed on the shafts of the impeller and rotor. The gears have the transmission ratio

$$i_{12}=\frac{\omega_1}{\omega_2}=\frac{n_1}{n_2}=-\frac{1}{3}$$

where ω_1, ω_2, n_1 and n_2 are the angular velocities and speeds of impeller 1 and rotor 2.

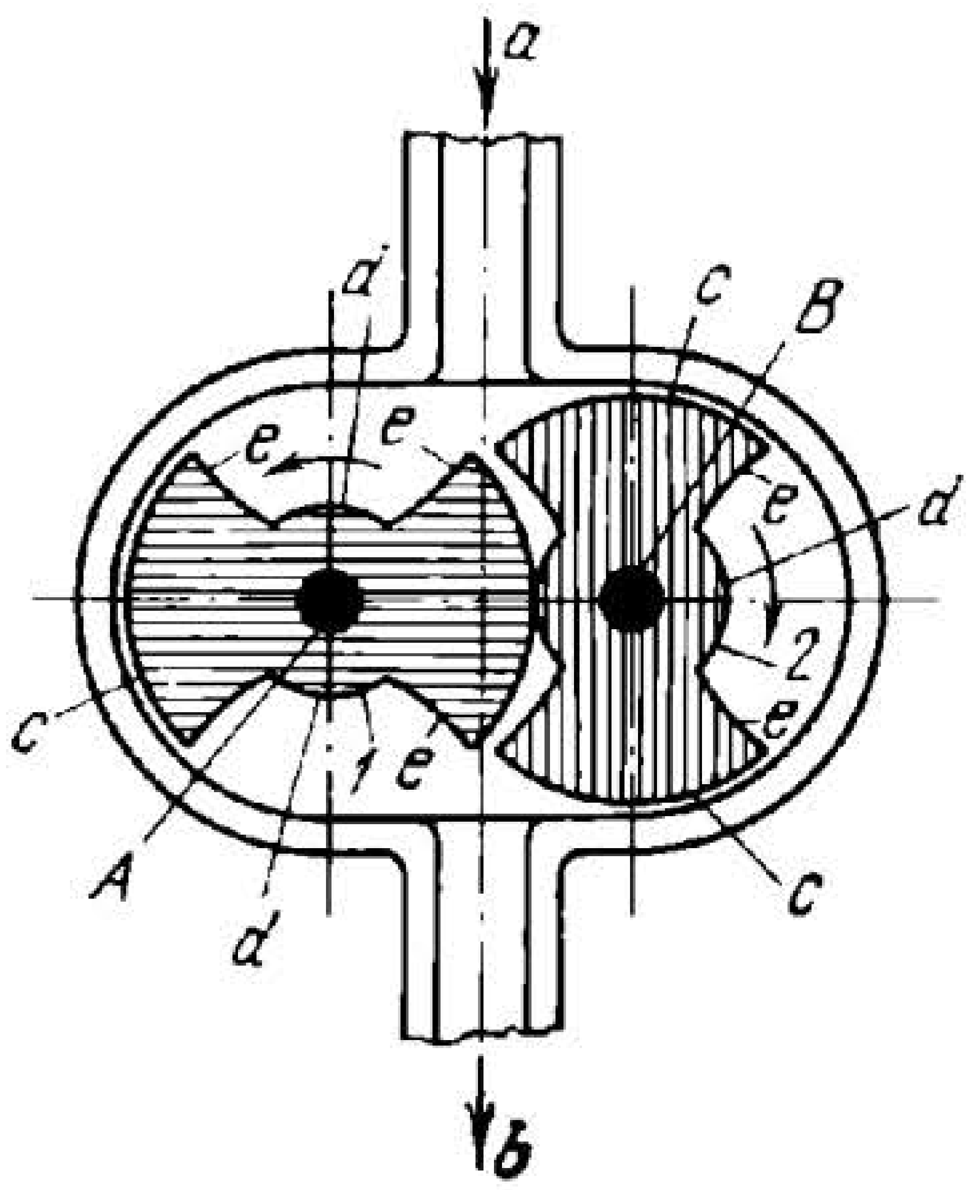
4003	ROTARY GEAR PUMP MECHANISM	THP GP

Impellers 1 and 2 rotate about fixed axes A and B. Impeller 1 has two teeth d and impeller 2 has two recesses c whose profiles are made up of portions of cycle curves. When impellers 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting special profiles to teeth d and recesses c of the impellers. The impellers are driven by two meshing identical gears keyed to the shafts of impellers 1 and 2.

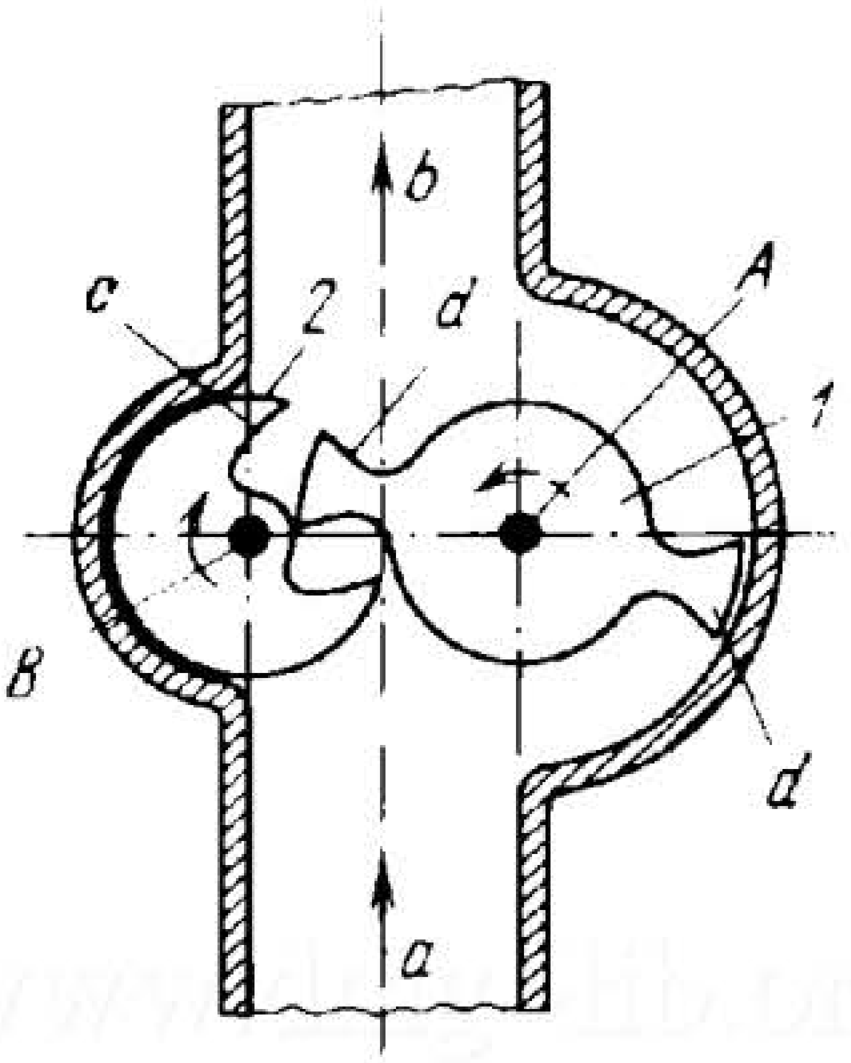


4004	ROTARY GEAR PUMP MECHANISM	THP GP

Two identical impellers, 1 and 2, rotate about fixed axes A and B. Parts c and d of the impeller profile are circular arcs; parts e are cycle curves. When impellers 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting special profiles to impellers 1 and 2. The impellers are driven by two meshing identical gears keyed to the shafts of impellers 1 and 2.



4005	TWO-TOOTH ROTARY PUMP MECHANISM WITH A DISTRIBUTOR ROTOR	THP GP



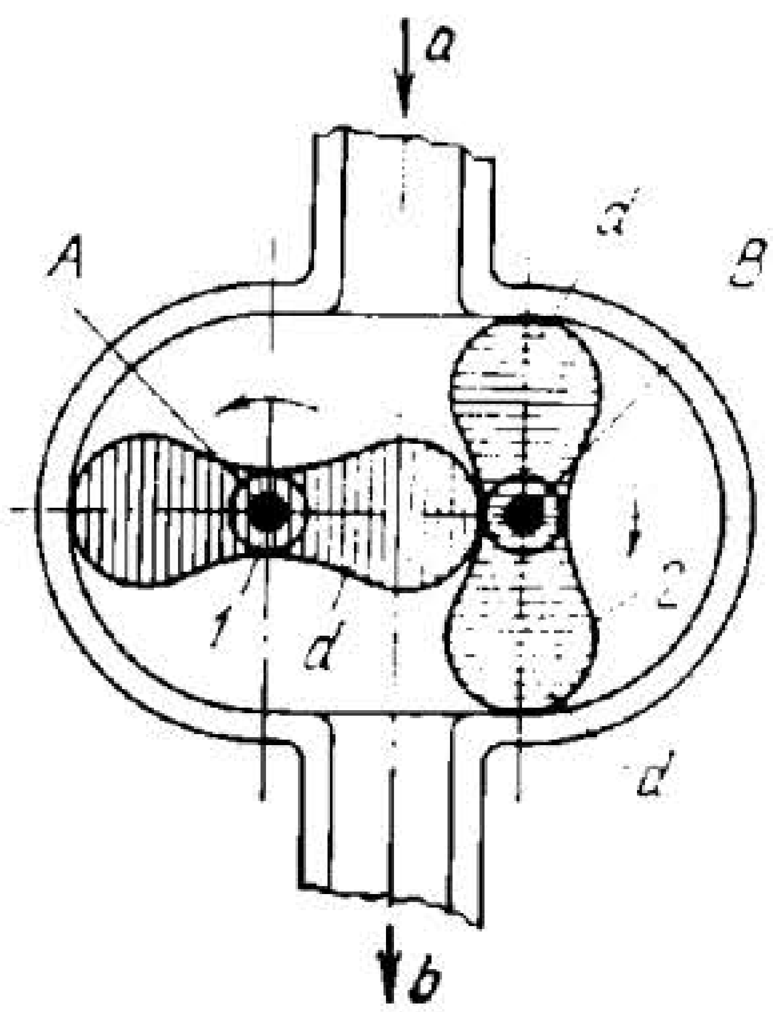
Impeller 1 rotates about fixed axis A and has two symmetrically arranged teeth d. Distributor rotor 2 rotates about fixed axis B and has recess c. The profiles of recess c and of teeth d are made up of portions of cycle curves. When impeller 1 and rotor 2 rotate, fluid (air or liquid) is continuously delivered in the direction of arrows a and b. The suction and discharge chambers are separated by imparting special profiles to teeth d and recess c of the impeller and rotor. The impeller and rotor are driven by two meshing gears keyed to the shafts of impeller 1 and rotor 2. The gears have the transmission ratio

$$i_{12}=\frac{\omega_1}{\omega_2}=\frac{n_1}{n_2}=-\frac{1}{2}$$

where ω_1, ω_2, n_1 and n_2 are the angular velocities and speeds of impeller 1 and rotor 2.

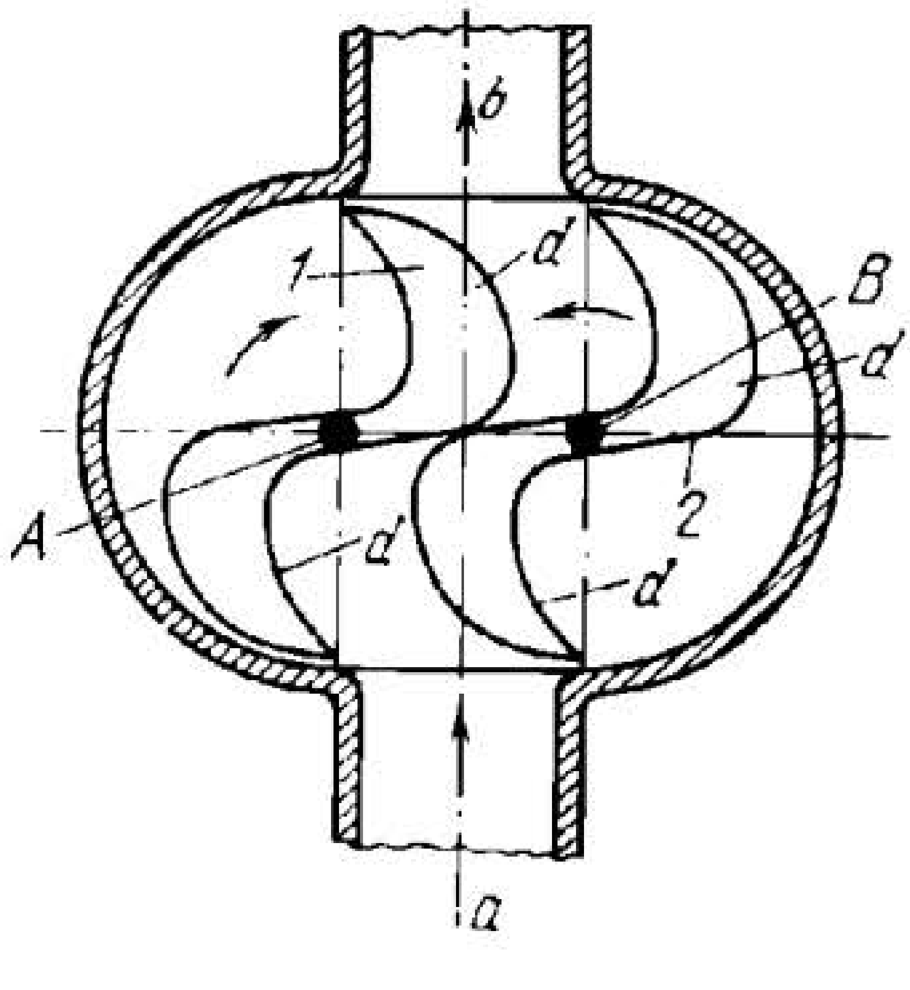
4006	ROOTS ROTARY GEAR PUMP MECHANISM	THP GP

Impellers *1* and *2* rotate about fixed axes *A* and *B* and have identical and symmetrically arranged teeth *d* whose profile is made up of portions of cycle curves. When impellers *1* and *2* rotate, fluid is continuously delivered in the direction of arrows *a* and *b*. The suction and discharge chambers are separated by imparting special profiles to impellers *1* and *2*. The impellers are driven by two meshing identical gears keyed to the shafts of impellers *1* and *2*.

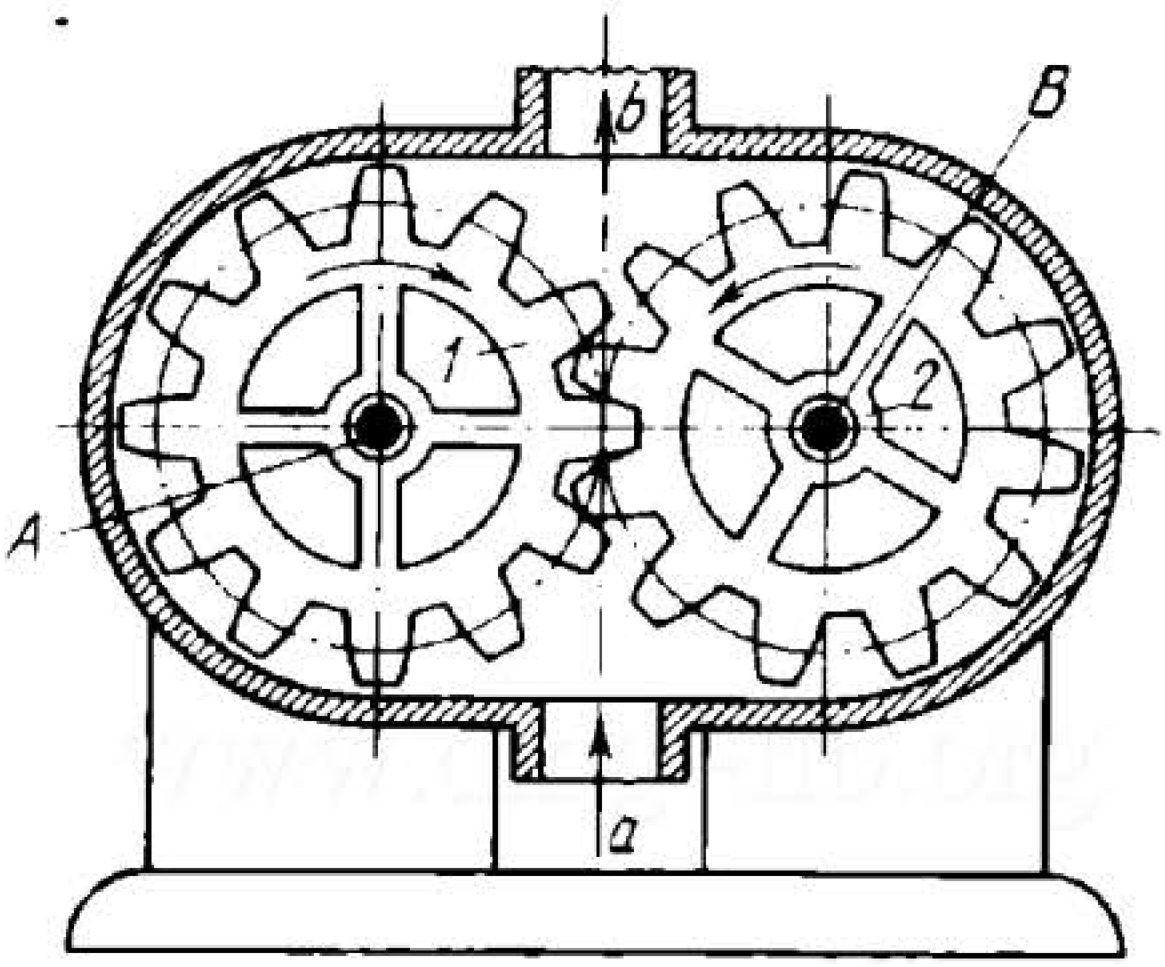


4007	ROTARY GEAR PUMP MECHANISM	THP GP

Two identical impellers, *1* and *2*, rotate about fixed axes *A* and *B* and have two teeth *d* each with profiles made up of portions of cycle curves. When impellers *1* and *2* rotate, fluid (air or liquid) is continuously delivered in the direction of arrows *a* and *b*. The suction and discharge chambers are separated by imparting special profiles to impellers *1* and *2*. The impellers are driven by two meshing identical gears keyed to the shafts of impellers *1* and *2*.

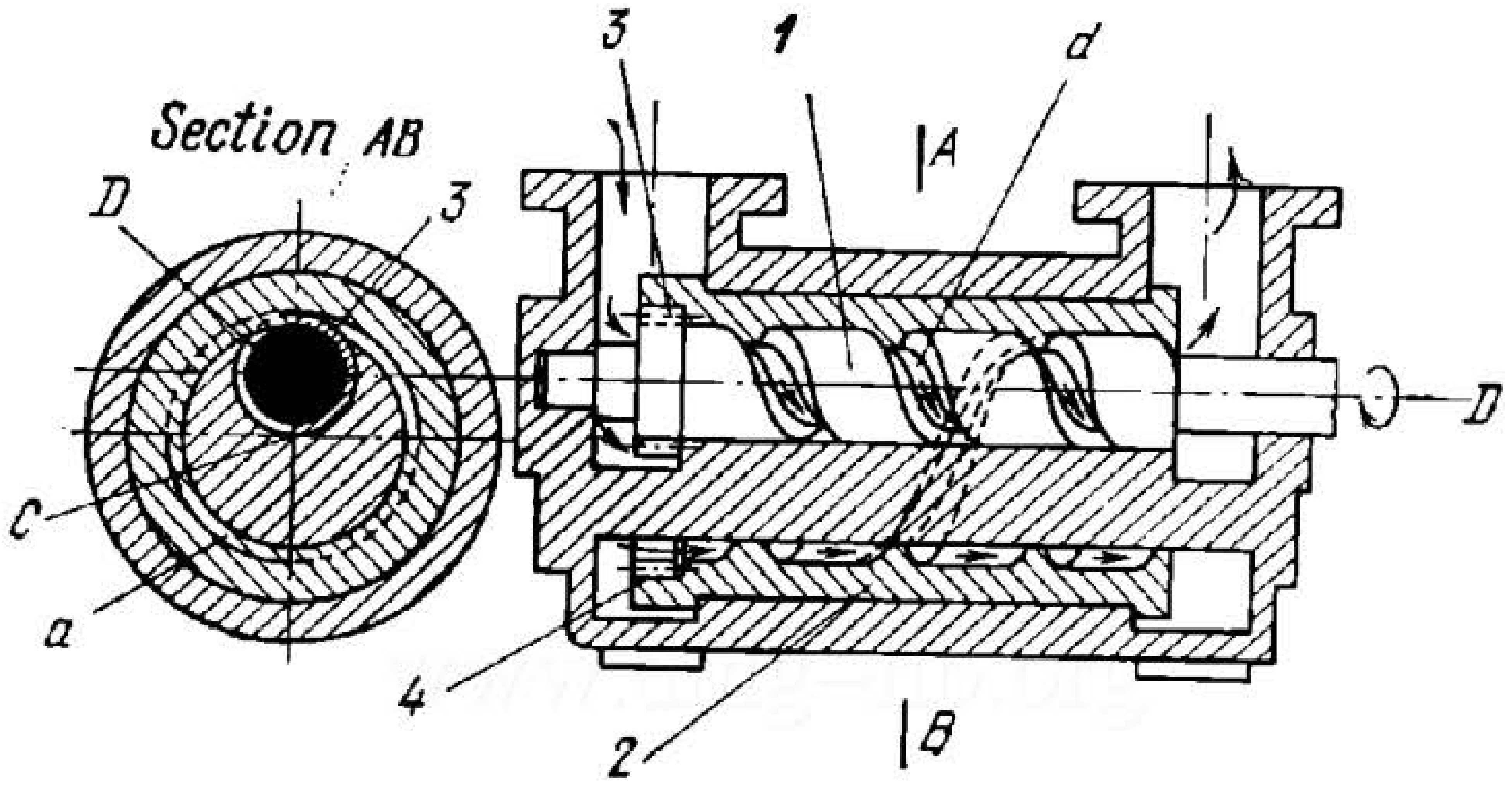


4008	ROTARY GEAR PUMP MECHANISM	THP GP



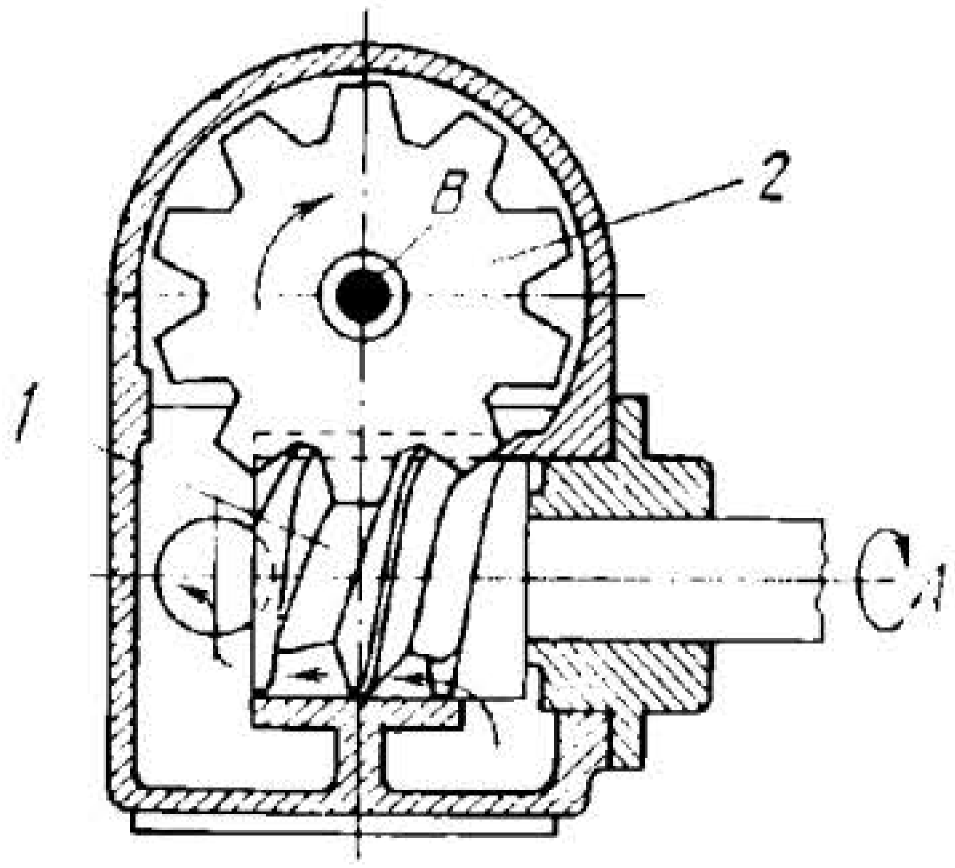
Two identical gears, 1 and 2, rotate about fixed axes A and B and have teeth with involute profiles. When gears 1 and 2 rotate, fluid is continuously delivered in the direction of arrows a and b.

4009	ROTARY SCREW PUMP MECHANISM	THP GP



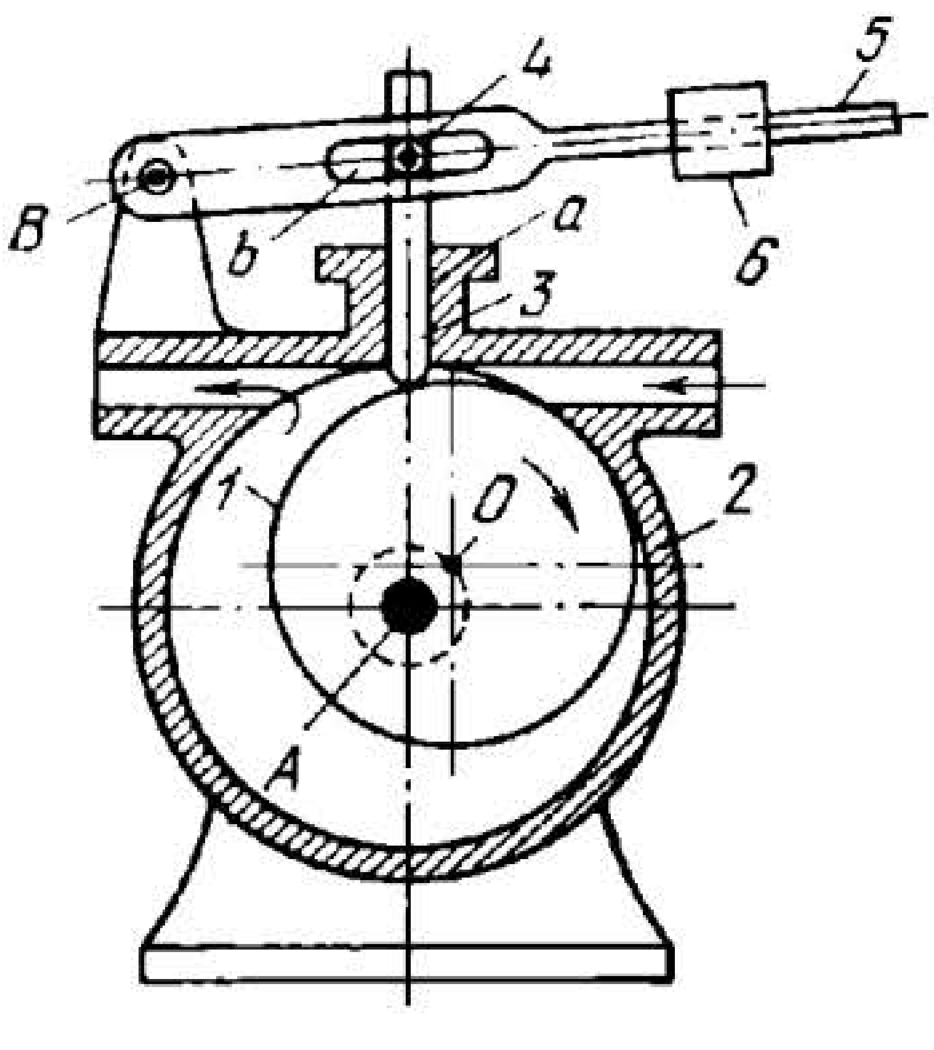
Screw *1*, having a two-start helical groove *d*, rotates about fixed axis *D* and is the element driven by external power. At its left end screw *1* has gear *3* which meshes with internal gear *4* having twice as many teeth as external gear *3* and is rigidly attached to internal link *2*, rotating about fixed axis *C*. Link *2* has a single-start internal helical projection (thread) *a* fitting into groove *d* of screw *1*. The inside diameter of link *2* (disregarding the projection) is twice the outside diameter of screw *1*. When screw *1* rotates, it rotates link *2* and fluid is delivered in the direction of the arrows.

4010	ROTARY WORM PUMP MECHANISM	THP GP



Worm 1 rotates about fixed axis A and meshes with worm wheel 2 which rotates about fixed axis B. When worm 1 rotates, fluid is delivered between the thread of the worm and the housing in the direction of the arrows. Worm wheel 2 serves to divide the worm thread groove into sections.

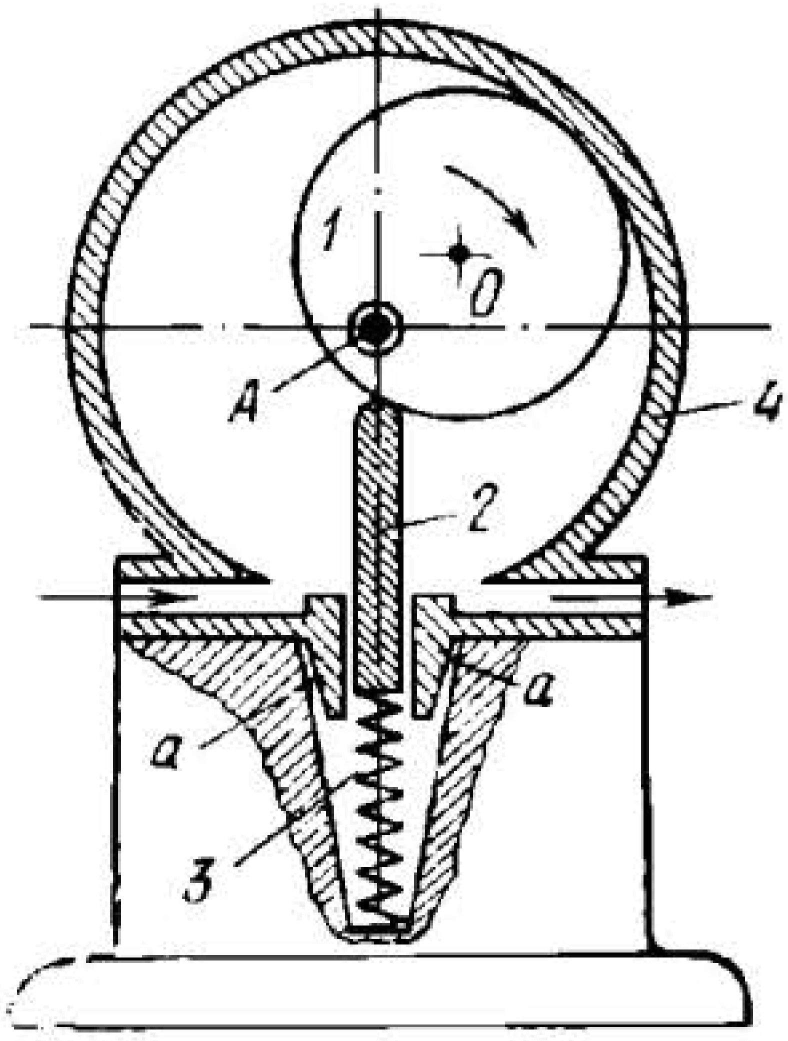
4011	LEVER-CAM MECHANISM OF A WEIGHT-LOADED SLIDING-ABUTMENT ROTARY PUMP	THP GP



Circular rotor 1 rotates about eccentrically located fixed axis A, coinciding with the geometric axis of housing 2. Sliding abutment 3 reciprocates in fixed guide a and has roller 4 which rolls and slides along slot b of loading lever 5. Lever 5 turns about fixed axis B and its weight 6 can be adjusted to the required position along the axis of the lever to hold abutment 3 against rotor 1. When rotor 1 rotates, it slides along the internal surface of housing 2 and delivers fluid in the direction of the arrows. Abutment 3 separates the suction and discharge chambers.

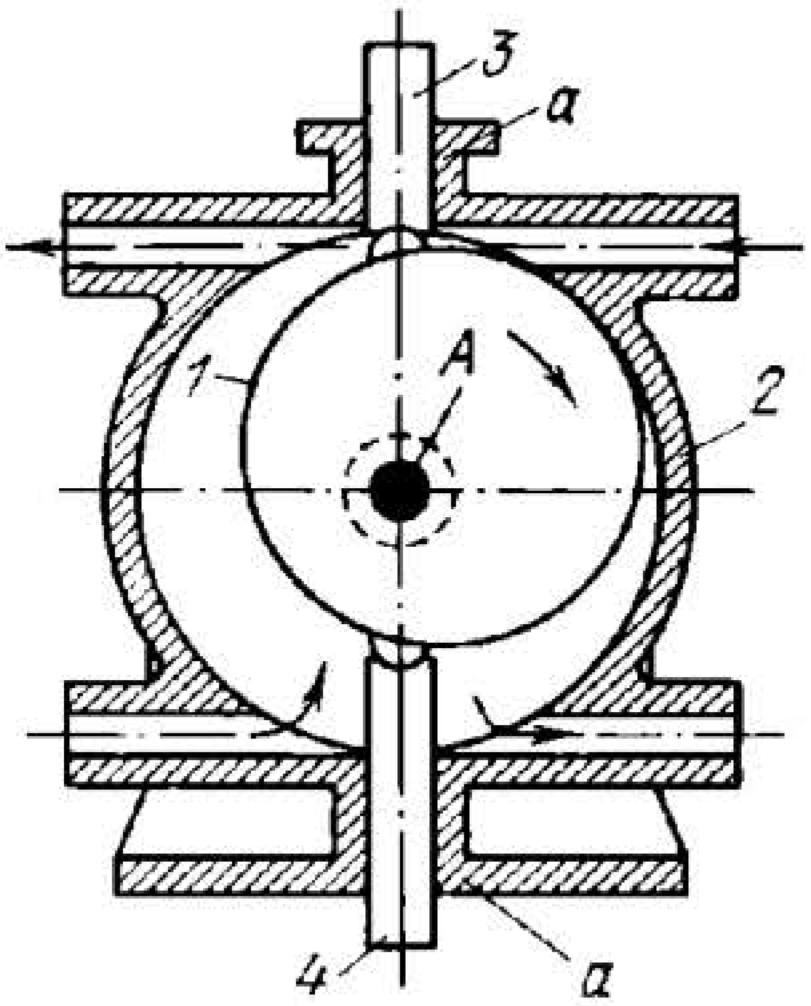
4012	LEVER-CAM MECHANISM OF A SLIDING-ABUTMENT ROTARY PUMP	THP GP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *4*. Sliding abutment *2* reciprocates in fixed guides *a* and is held against rotor *1* by the action of spring *3*. When rotor *1* rotates, it slides along the internal surface of housing *4* and delivers fluid in the direction of the arrows. Abutment *2* separates the suction and discharge chambers.

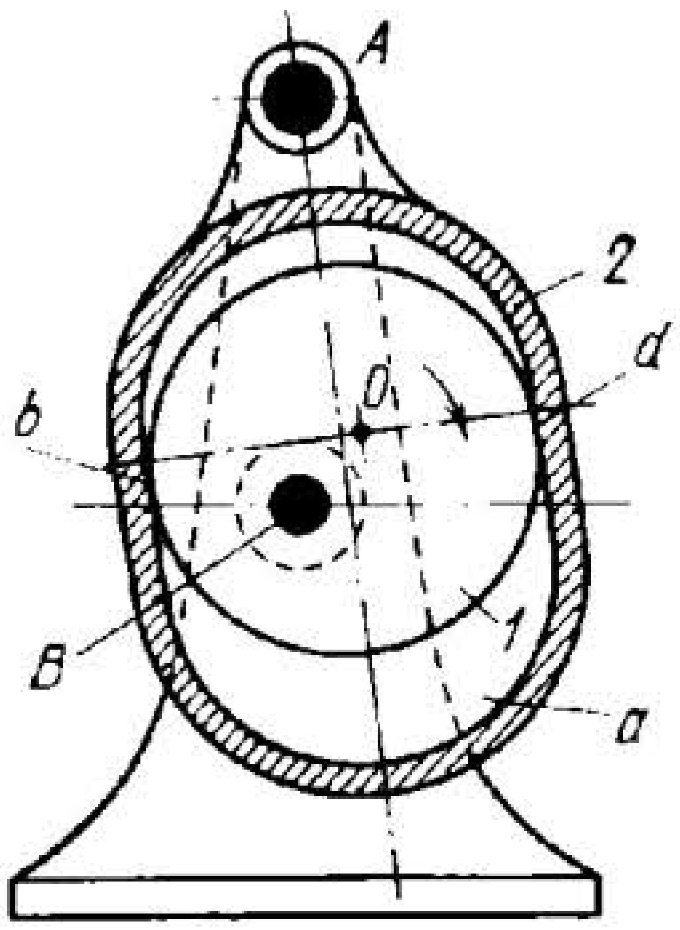


4013	LEVER-CAM MECHANISM OF TWO-CHAMBER DOUBLE-ABUTMENT ROTARY PUMP	THP GP

Circular rotor *1* rotates about eccentrically located fixed axis *A*, coinciding with the geometric axis of housing *2*. Abutments *3* and *4* reciprocate in fixed guides *a* of housing *2* and are held against rotor *1* by means of springs (not shown). When rotor *1* rotates, fluid is delivered in the directions of the arrows. Abutments *3* and *4* divide the pump into two chambers so that the process of suction and discharge is repeated twice for each revolution of rotor *1*.

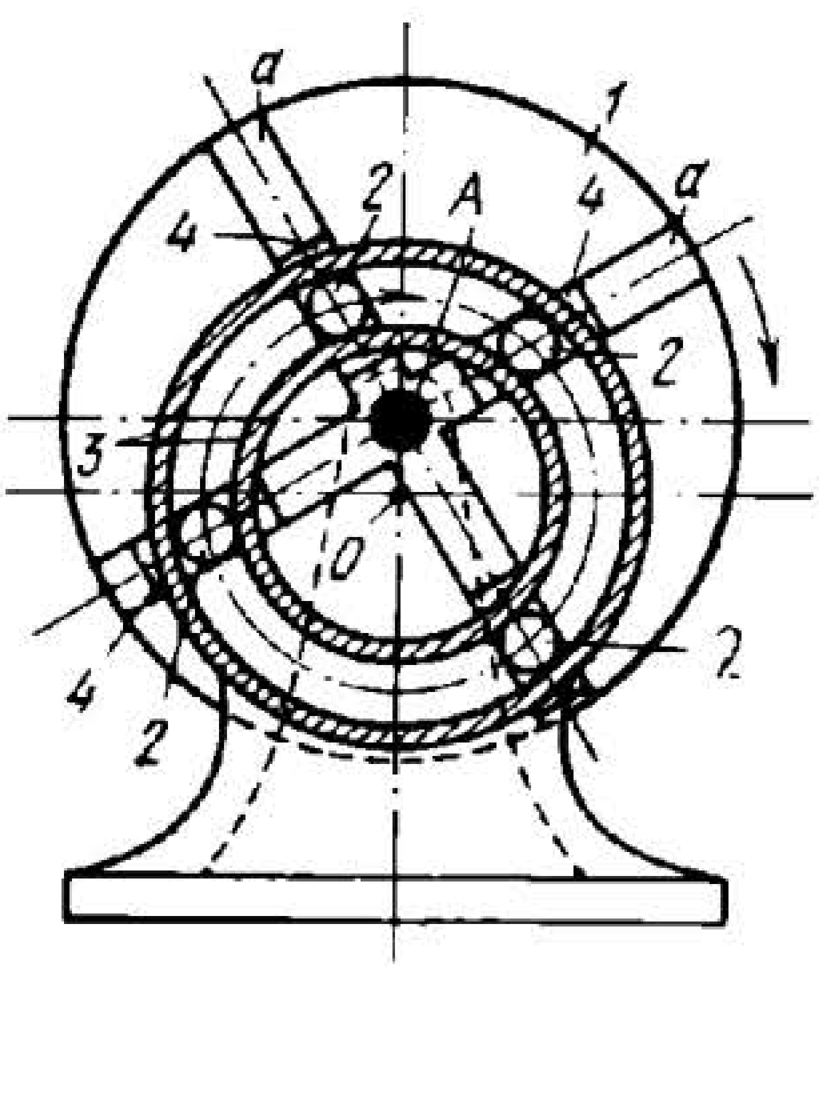


4014	LEVER-CAM MECHANISM OF A ROTARY PUMP WITH AN OSCILLATING HOUSING	THP GP



Circular rotor 1 rotates about eccentrically located fixed axis B (with respect to the geometric centre O of the rotor). Housing 2 is of oval shape with its internal surface constantly contacting rotor 1 at two opposite points, for instance, b and d. When rotor 1 rotates, housing 2 oscillates about fixed axis A. In each revolution of rotor 1, suction and discharge occur in two chambers a, separated by the rotor. Fluid is drawn in and discharged in a direction perpendicular to the plane of the drawing.

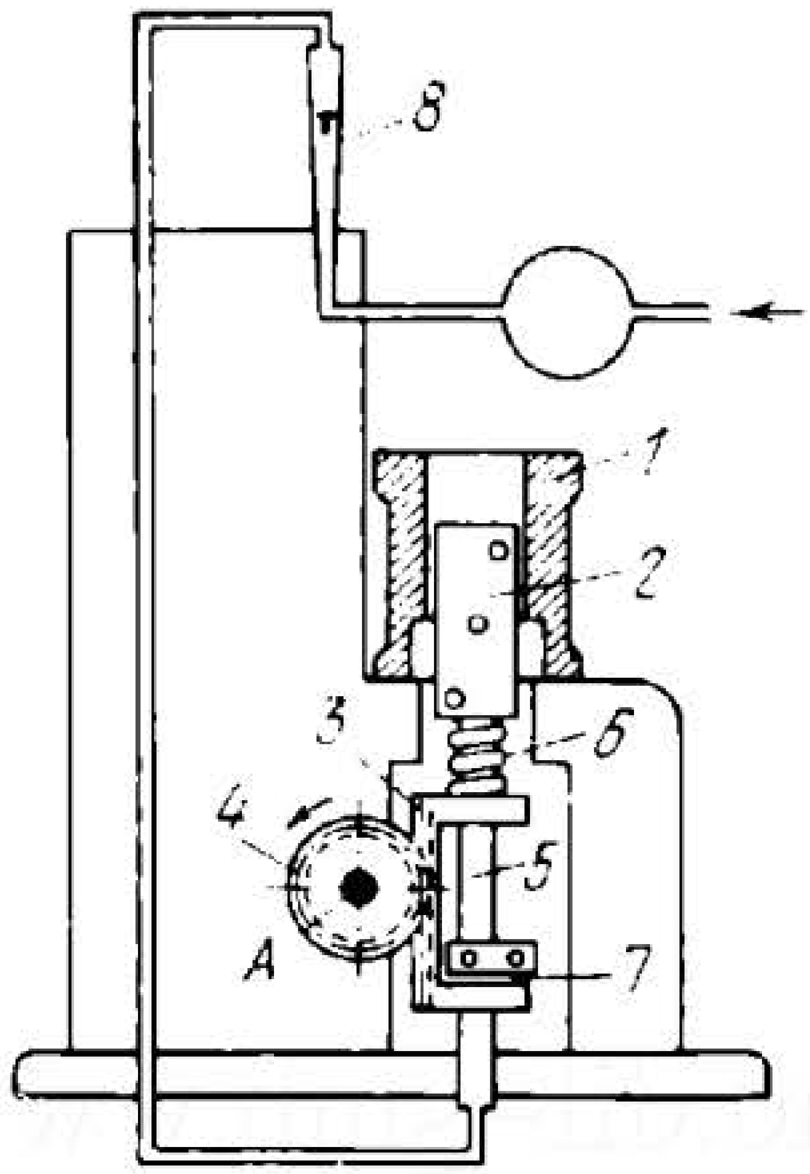
4015	FIXED-CAM ROTARY PISTON PUMP MECHANISM	THP GP



Rotor 1 rotates about fixed axis A and has guides a with perpendicular axes. Reciprocating in guides a are pistons 4 which have rollers 2. These rollers roll and slide along the groove of fixed face cam 3. The centre line of the groove is a circle with its centre at point O, located eccentrically with respect to axis A. When rotor 1 rotates, pistons 4 reciprocate and deliver a fluid, drawing it in and discharging it along passages which are not shown.

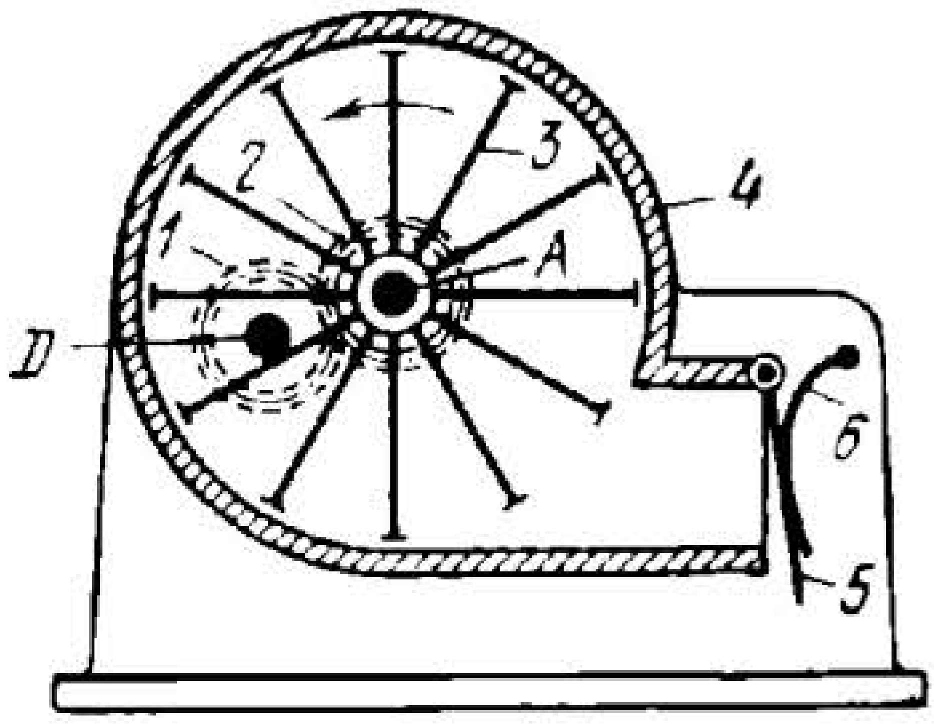
3. MECHANISMS OF MEASURING AND TESTING DEVICES (4016 through 4021)

4016	RACK-AND-PINION MECHANISM OF A PNEUMATIC FLOW GAUGE WITH AUTOMATIC DRIVE CUT-OUT	THP M



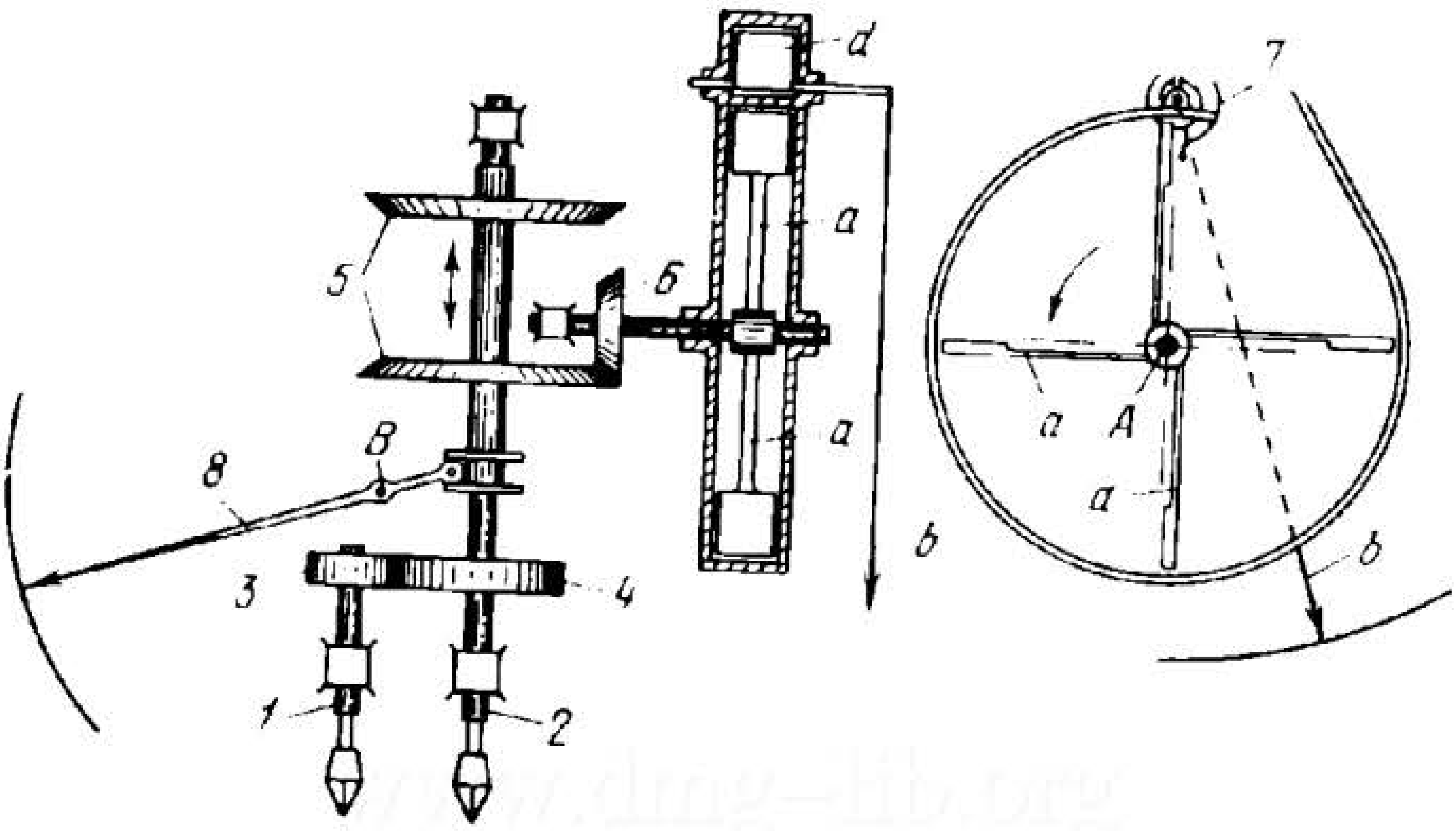
In checking the bore diameter and surface of cylinder *1*, measuring head *2* is inserted into the cylinder by means of gear rack *3* which meshes with pinion *4*, rotating about fixed axis *A*. If in its upward travel the measuring head encounters any obstacle (decreased bore diameter, flaw in the wall, etc.), it stops and rack *3*, moving upward along stationary rod *5*, compresses spring *6* and, by means of microswitch *7*, switches off the electric motor of the drive. This also transmits a signal indicating that there is a flaw in the cylinder. The bore diameter is measured by the flow of compressed air through internally tapered glass indicator column *8* to measuring head *2* and out through the clearance between the head and the bore. The flow-gauge scale is graduated in units of the deviation of the actual size from the specified value.

4017	GEARING MECHANISM OF A PNEUMATIC TACHOMETER WITH AN IMPELLER	THP M



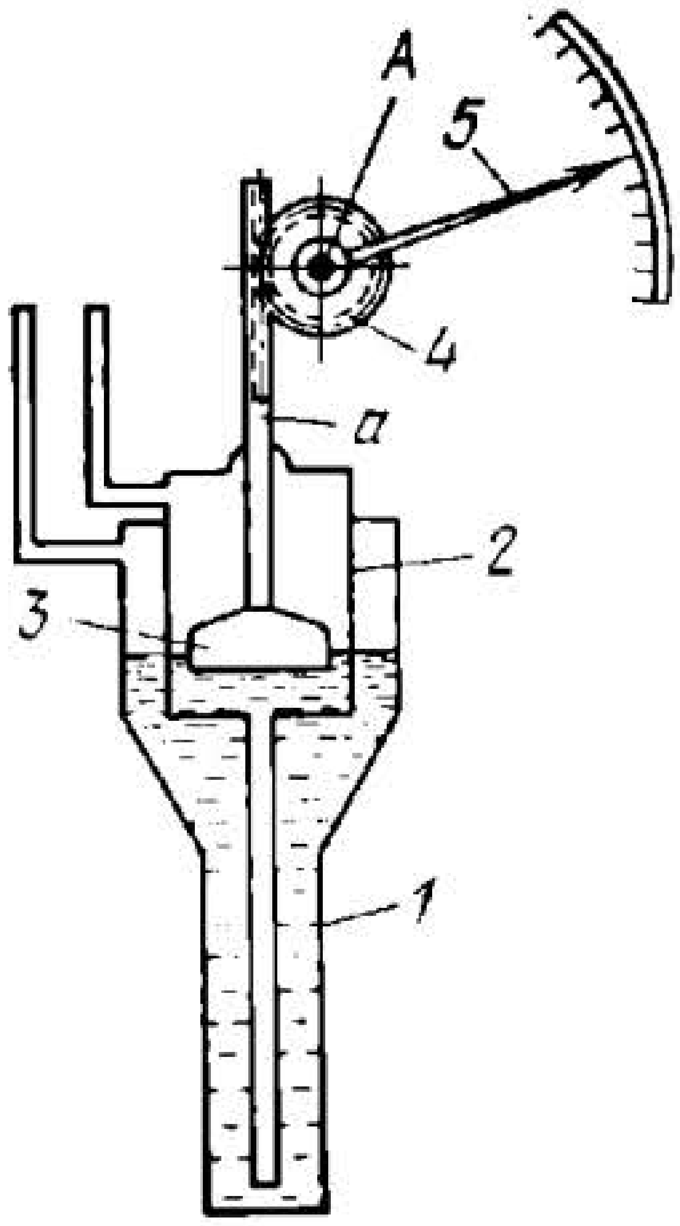
If the shaft whose speed is being measured rotates counterclockwise, the tachometer shaft with axis A is linked to the shaft being tested. If the tested shaft rotates clockwise, it is linked to the tachometer shaft with axis D and rotation is transmitted through gears *1* and *2* to impeller *3*. Thus, impeller *3* always rotates counterclockwise. The vanes of impeller *3* deliver air in the direction of the tangential outlet of housing *4*, lifting shutter *5* and overcoming the resistance of flat spring *6*. The pressure of the air against shutter *5* and the angle through which it is turned depend upon the angular velocity of the shaft being tested. The shaft speed is indicated by the hand of an instrument linked to shutter *5*.

4018	GEARING MECHANISM OF A PNEUMATIC TACHOMETER WITH AN IMPELLER	THP M



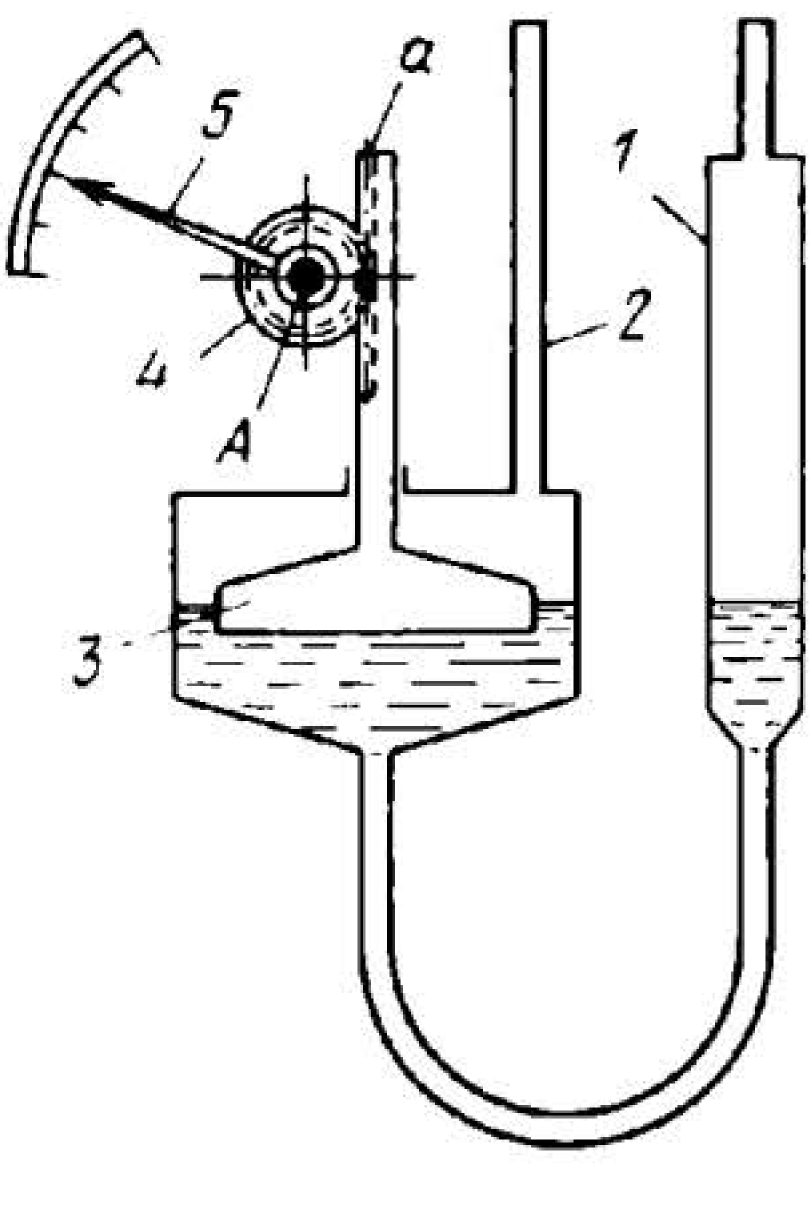
Rotation of high-speed spindle *1* is transmitted through gears *3* and *4* to low-speed spindle *2* and further, through bevel gears *5* and *6*, to the impeller with vanes *a*. The impeller is keyed to the shaft of gear *6* and rotates counterclockwise about axis *A*. Rotating in the housing, vanes *a* deliver a stream of air directed against vane *d* which is rigidly attached to hand *b*. The torque on vane *d* is counterbalanced by spiral spring *7* which is wound up by this torque a proportional amount. Since the impeller must always rotate in the same direction, regardless of the direction of rotation of the shaft whose speed is being measured, the drive can be reversed by bringing the other gear *5* into mesh with gear *6*. Gears *5* are shifted in and out of mesh by lever-hand *8* which turns about fixed axis *B*.

4019	RACK-AND-PINION MECHANISM OF A FLOAT-TYPE DIFFERENTIAL MANOMETER WITH CONCENTRIC VESSELS	THP M



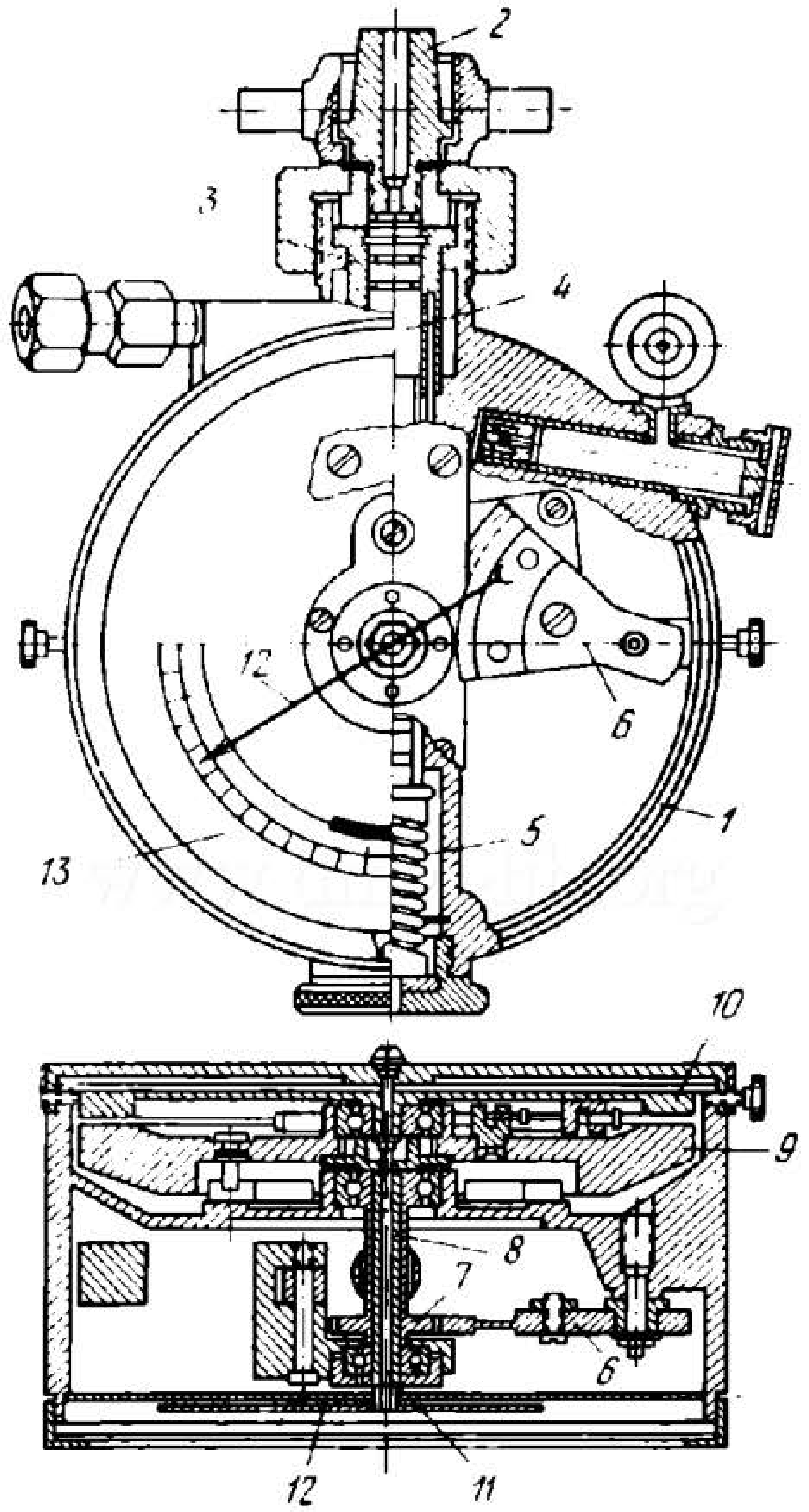
Upon a change in pressure in vessel *1*, filled with mercury and communicating with vessel *2*, float *3* is raised or lowered. Float *3* has a stem with rack *a*. The motion of float *3* is transmitted through pinion *4*, meshing with rack *a*, to hand *5* which is rigidly attached to the pinion and turns about fixed axis *A*.

4020	RACK-AND-PINION MECHANISM OF A FLOAT-TYPE DIFFERENTIAL MANOMETER	THP M



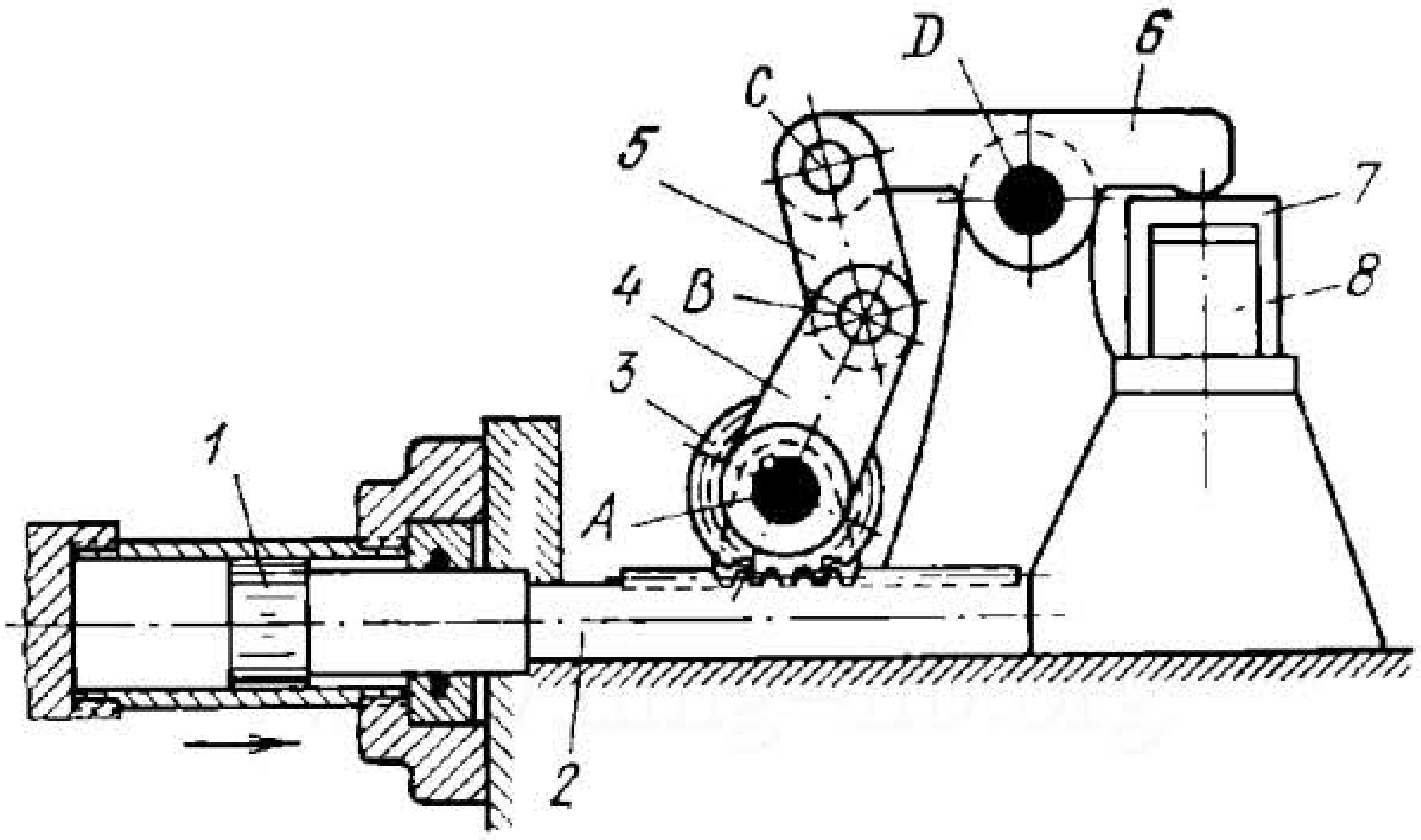
Upon a change in pressure in vessel *1*, filled with mercury and communicating with vessel *2*, float *3* is raised or lowered. Float *3* has a stem with rack *a*. The motion of float *3* is transmitted through pinion *4*, meshing with rack *a*, to hand *5* which is rigidly attached to the pinion and turns about fixed axis *A*.

4021	LEVER-GEAR MECHANISM OF A GAS MEAN-PRESSURE INDICATOR	THP M



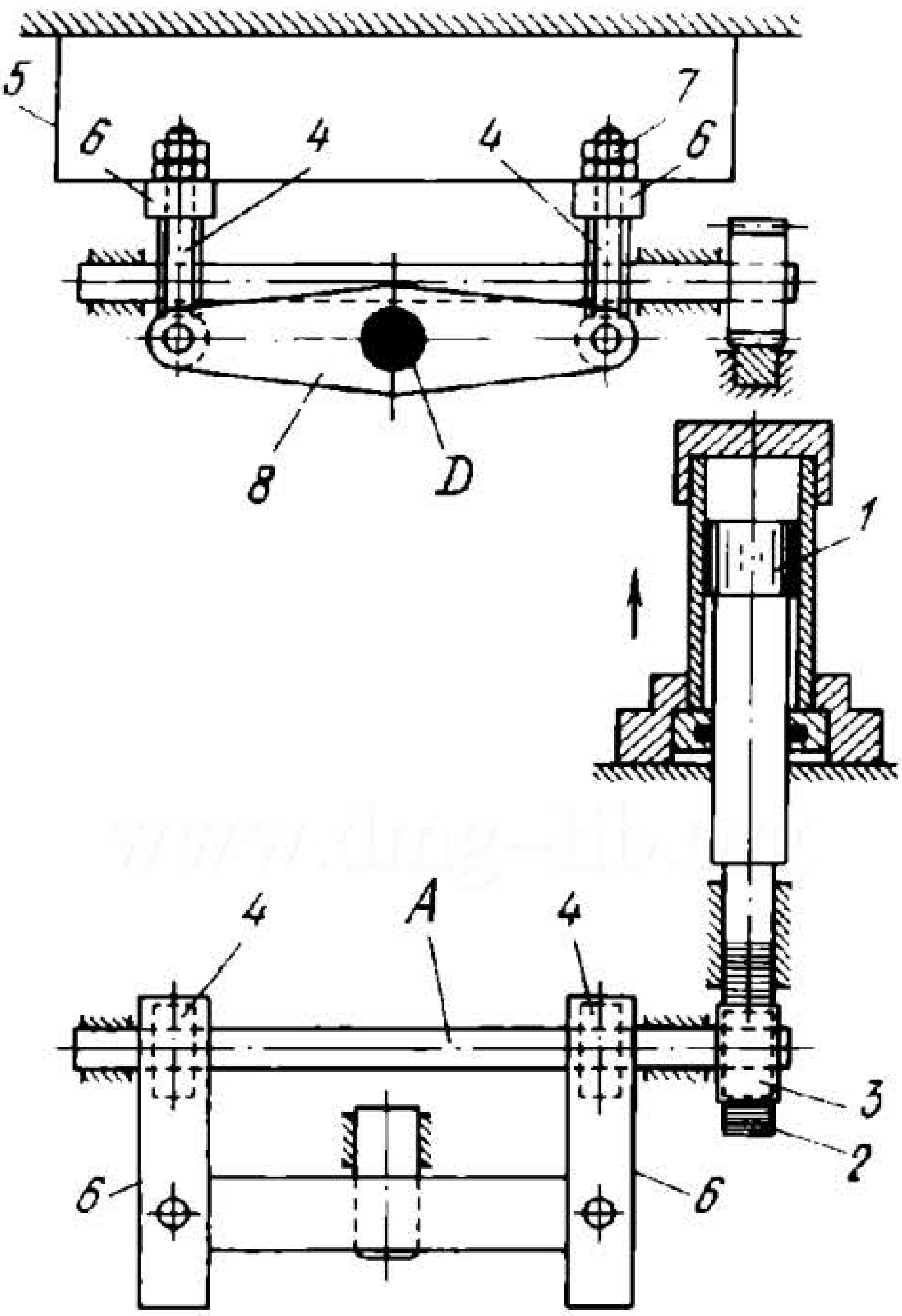
The reading of this indicator is the gas mean pressure in an engine cylinder during a complete cycle of the engine. The housing *1* of the instrument is connected to the space in which the pressure is to be measured by connection *2*. The housing contains cylinder *3* with plunger *4*. The pressure of the gas moves plunger *4* downward, compressing spring *5*. Through a four-bar linkwork, motion of plunger *4* is transmitted to segment gear *6* which meshes with gear *7*. Mounted on the shaft of gear *7* is flywheel *9*. The flywheel has a considerable mass and it absorbs all the fluctuations in pressure acting on plunger *4*. Owing to its inertia, flywheel *9* holds plunger *4* in a position corresponding to the mean pressure. Flexibly linked to flywheel *9* through a spring is damping disk *10* which is mounted on shaft *11* together with hand *12* which indicates the mean pressure on scale *13* of the instrument.

4022	RACK-AND-PINION MECHANISM OF A HYDRAULIC CLAMPING DEVICE	THP GC



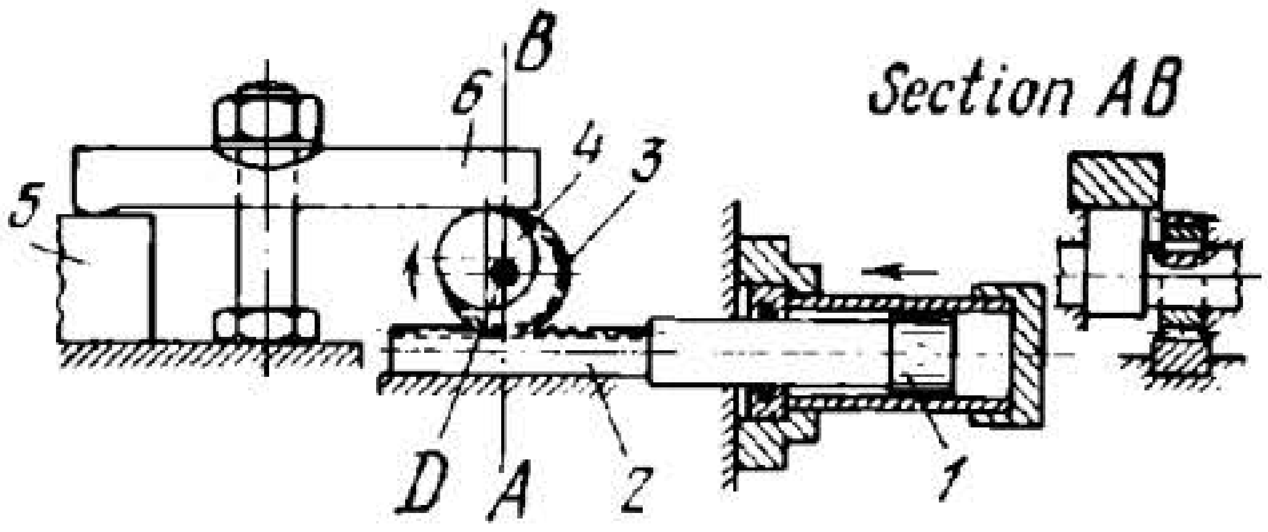
When piston *1* is moved to the right by the action of fluid delivered to the left end of its cylinder, gear rack *2*, rigidly attached to the piston rod, turns pinion *3* about fixed axis *A*. Pinion *3* is rigidly secured to lever *4*. Link *5* is connected by turning pairs *B* and *C* to lever *4* and to clamping lever *6* which turns about fixed axis *D*. Lever *6* clamps workpiece *7* which is located on pin *8*. Workpiece 7 is released in the return stroke of piston *1*.

4023	RACK-AND-PINION MECHANISM OF A HYDRAULIC ECCENTRIC CLAMPING DEVICE	THP GC



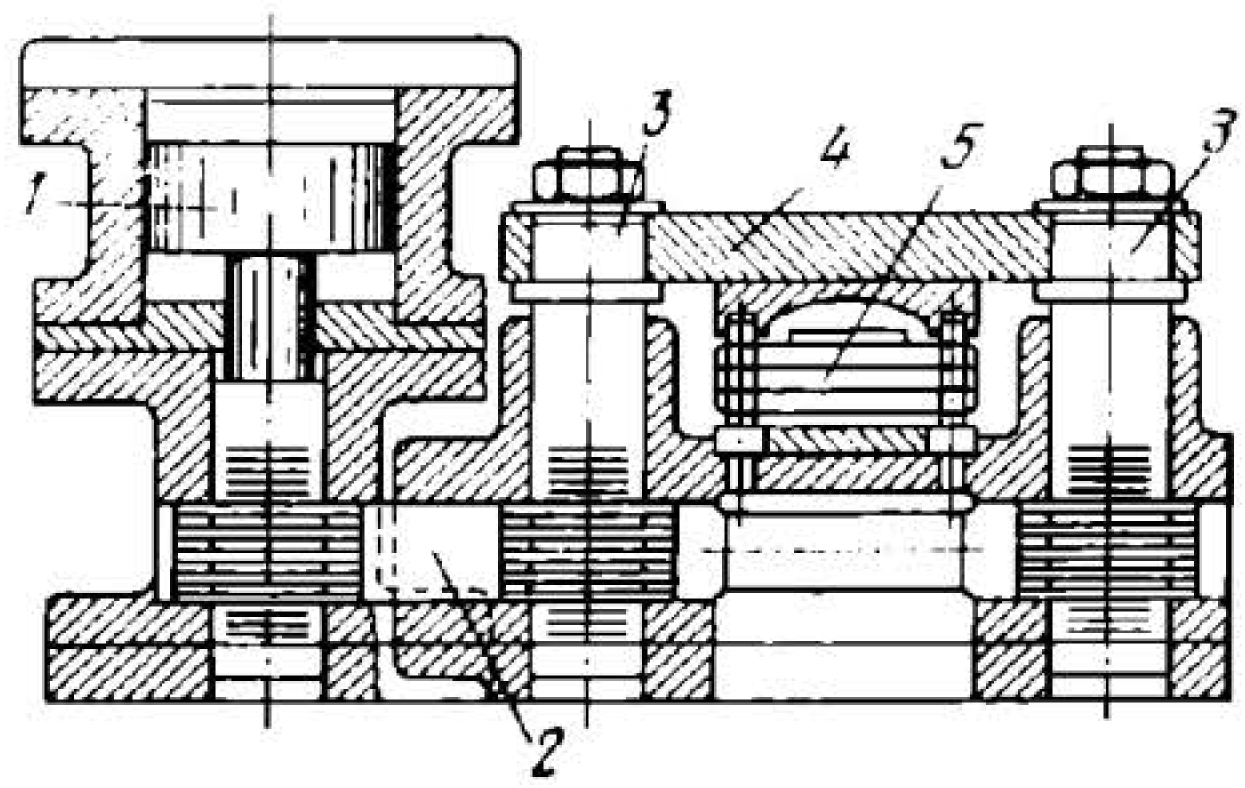
When piston *1* is moved forward by the action of fluid delivered to the end of its cylinder, gear rack *2*, rigidly attached to the piston rod, turns pinion *3* and shaft *A*. This turns eccentrics *4*, mounted on shaft *A*, actuating straps *6* which clamp workpiece *5*. In order to clamp the workpiece simultaneously with two eccentrics, bolts *7* are provided as supports on which straps *6* can tilt. These bolts are interlocked through crosspiece *8* which can turn about fixed axis *D*.

4024	RACK-AND-PINION MECHANISM OF A HYDRAULIC ECCENTRIC CLAMPING DEVICE	THP GC



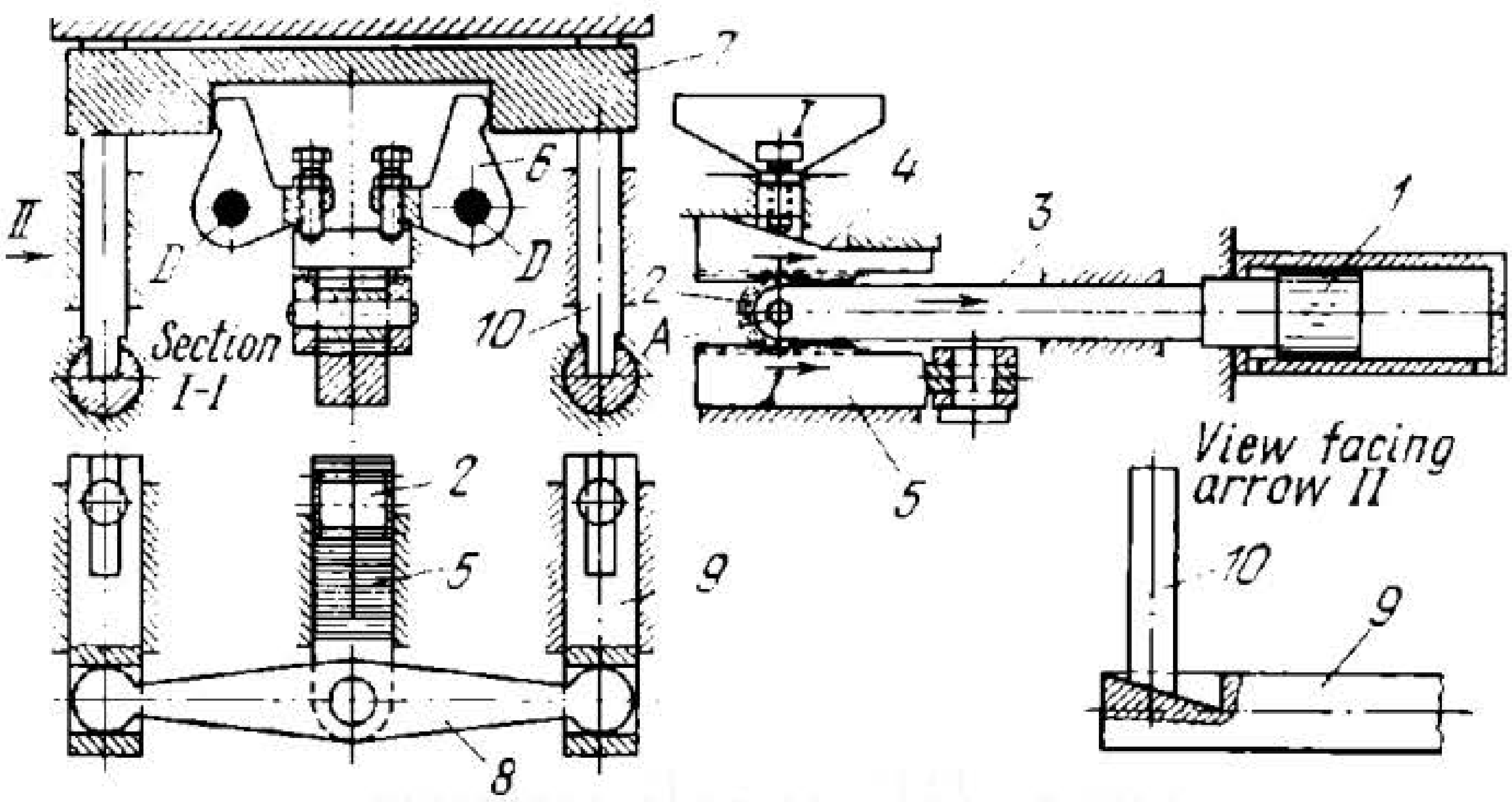
When piston *1* is moved to the left by the action of fluid delivered to the right end of toits cylinder, gear rack *2*, rigidly attached to the piston rod, turns pinion *3* about fixed axis *D*. This turns eccentric *4* which is keyed to the pinion shaft, actuating clamping lever *6*. With its other end lever *6* clamps workpiece *5*. When piston *1* is moved to the right, workpiece *5* is released.

4025	RACK-AND-PINION MECHANISM OF A HYDRAULIC CLAMPING DEVICE	THP GC



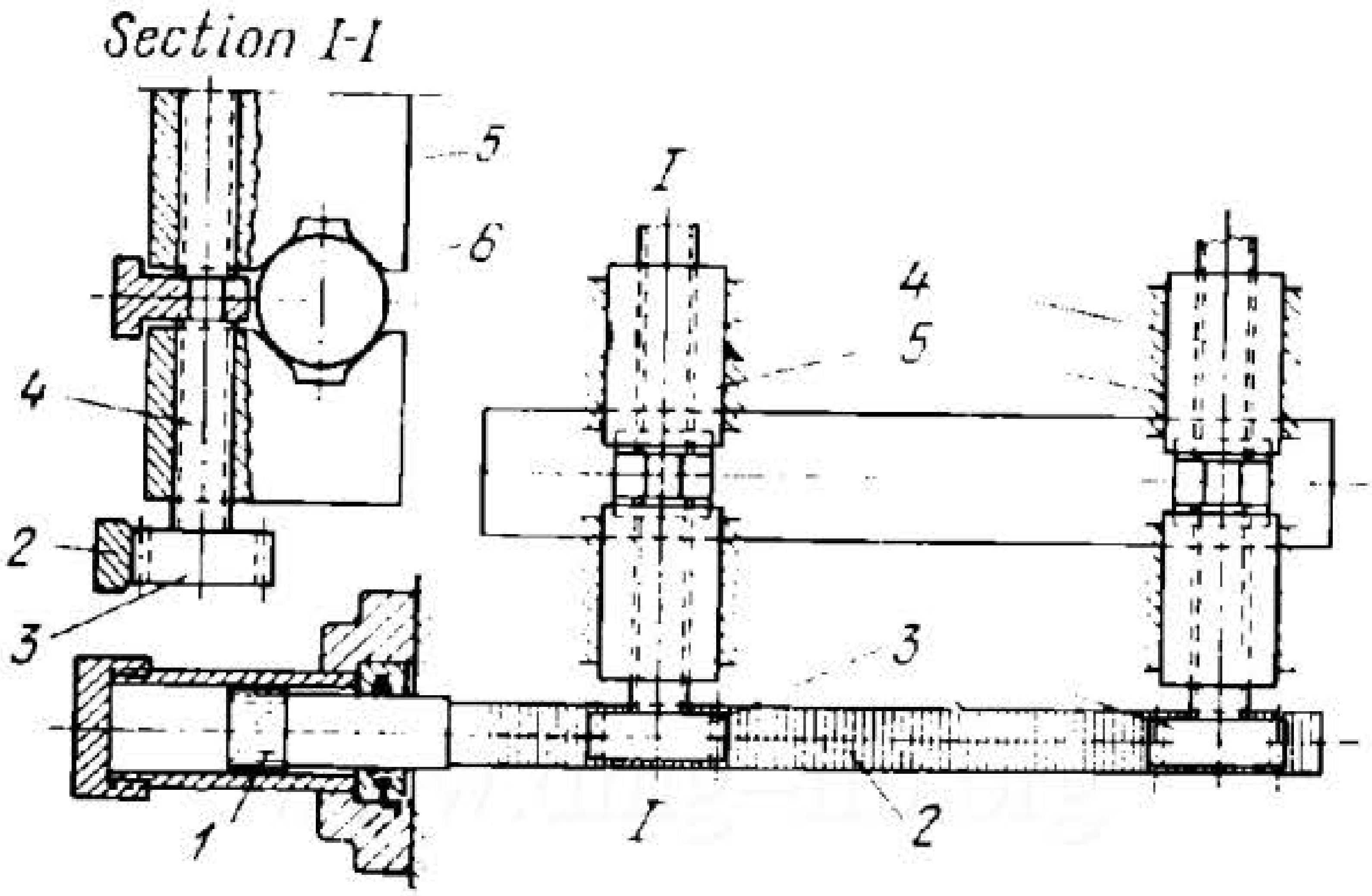
When piston *1* is moved downward by the action of fluid delivered to the top end of its piston, its rod, designed as a gear rack, turns pinion shaft *2*. Shaft *2* has three toothed portions and its motion is transmitted to columns *3*, having rack teeth and rigidly attached to top plate *4*. Downward motion of plate *4* clamps workpiece *5*. Top plate *4* is raised and workpiece *5* is released in the return stroke of piston *1*.

4026	RACK-AND-PINION MECHANISM OF A HYDRAULIC LOCATING AND CLAMPING DEVICE	THP GC



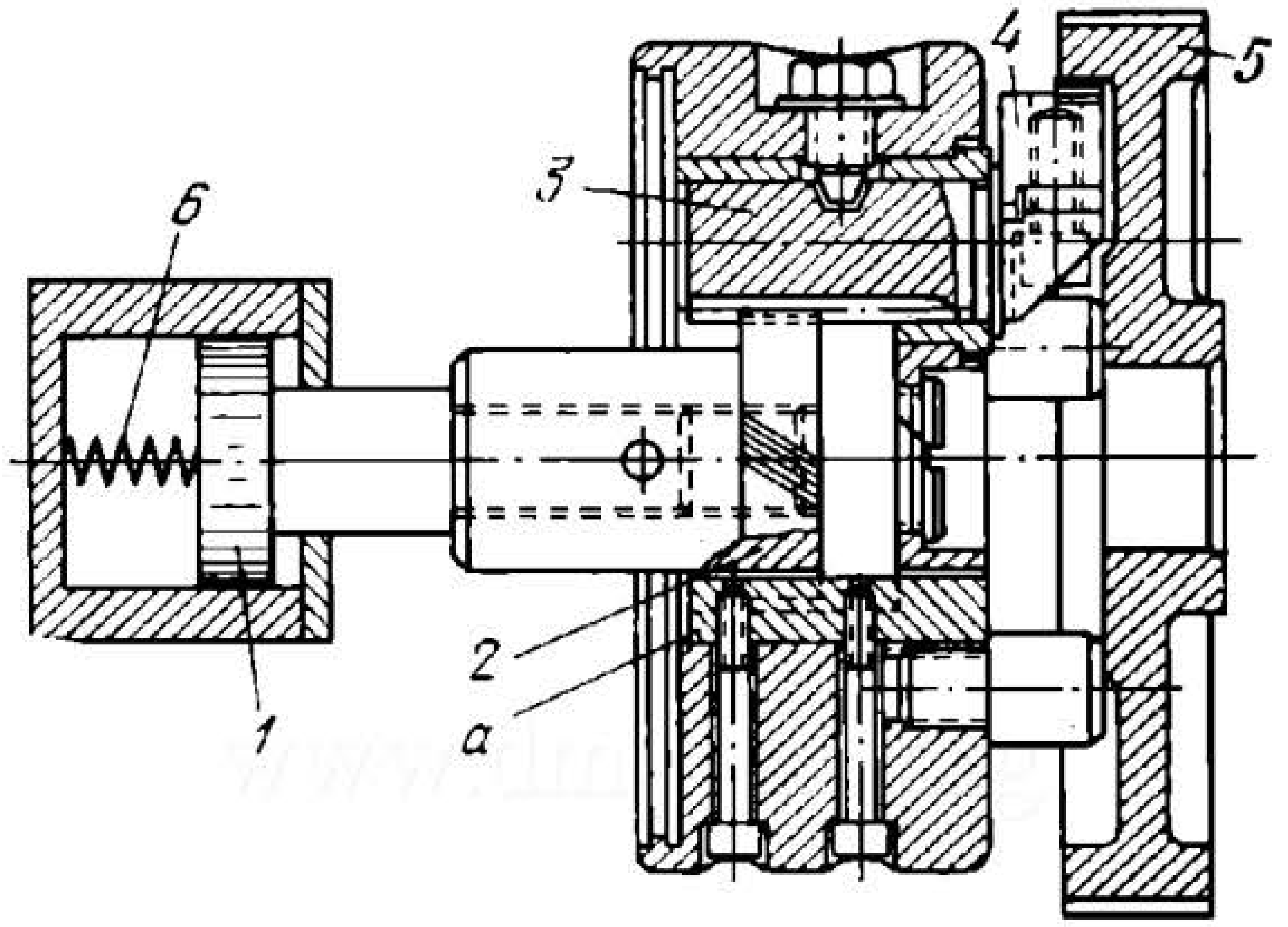
When piston *1* is moved to the right by the action of fluid delivered to the left end of its cylinder, pinion *2*, mounted on axle *A* which is pressfitted into the piston rod *3*, also moves to the right, actuating both gear racks, *4* and *5*. Upper rack *4* is integral with a wedge whose motion turns cam levers *6* about fixed axes *D* so that they locate workpiece *7* by its circular recess. Lower rack *5* carries crosspiece *8* whose ball-shaped ends enter slots in two plungers *9*. As they move to the right (see view facing arrow *II*), plungers *9* clamp workpiece *7* against the top plate through two pushers *10* which slide along inclined slots in plungers *9*. Thus, in the working stroke of piston *1*, pinion *2* moves both gear racks until the workpiece is located. This stops rack *4* and pinion *2* begins to rotate, moving rack *5* to the right until the workpiece is firmly clamped.

4027	PINION-AND-SCREW MECHANISM OF TWIN VISES	THP GC



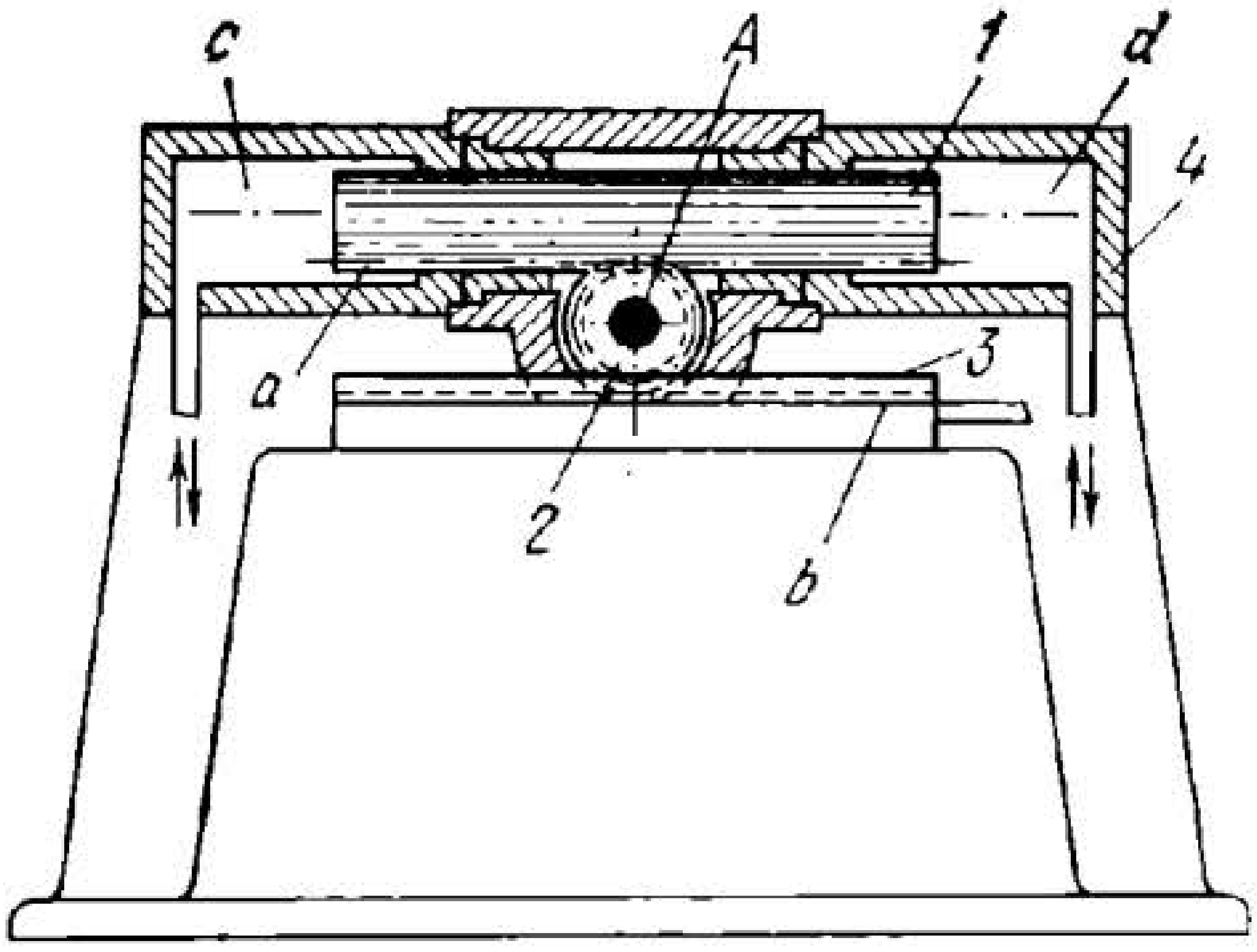
When piston *1* is moved to the right by the action of fluid delivered to the left end of its cylinder, gear rack *2*, rigidly attached to the piston rod, turns pinions *3* which are attached to screws *4*. Each screw *4* has two portions, one with right- and the other with left-hand thread, and the screws are constrained against axial movement. When the screws are rotated, V-block jaws *5* with internal right- and left-hand threads, mounted on the screws, move toward each other, locating and clamping round workpiece *6*. To compensate for differences in diameter of workpiece *6*, the torque is transmitted from pinion *3* to screw *4* in one of the two vises through a spiral spring (not shown).

4028	GEAR MECHANISM OF A HYDRAULIC THREE-JAW CHUCK	THP GC



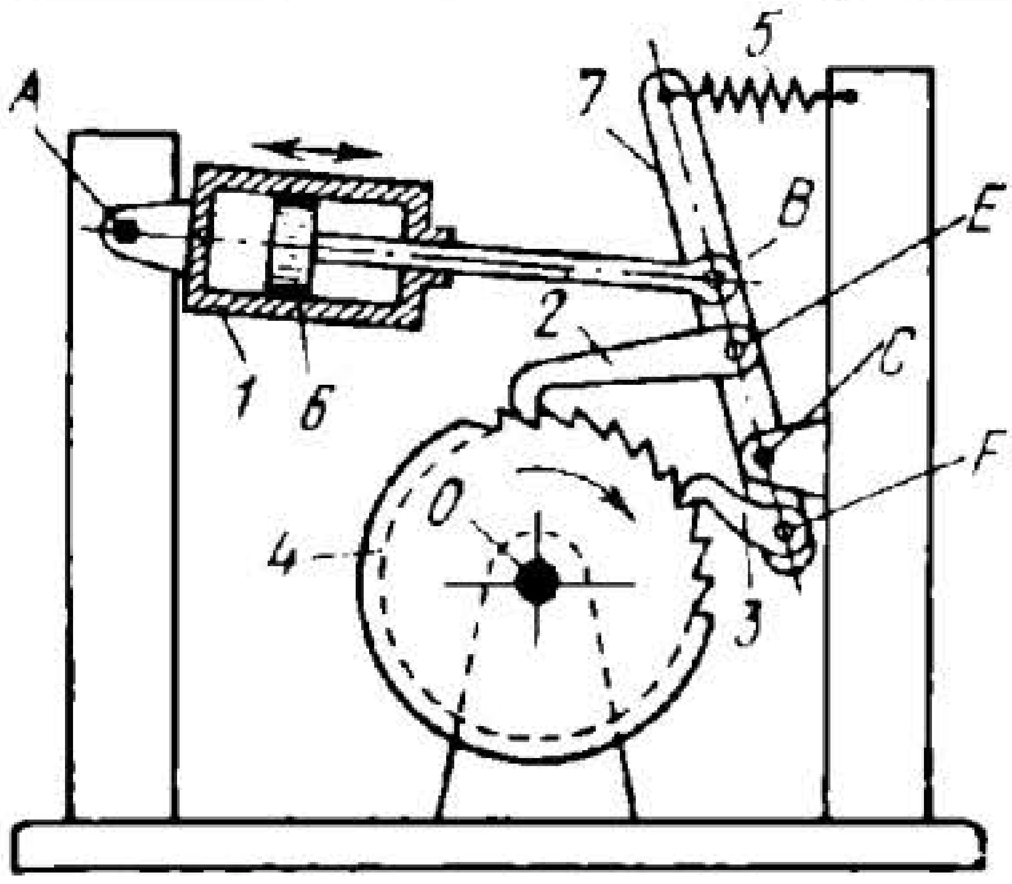
When piston 1 is moved to the left by the action of fluid delivered to the right end of its cylinder, helical gear 2, constrained against rotation by key a, moves to the left. This turns helical pinions 3 which mesh with gear 2 and carry jaws 4. As jaws 4 turn outward, they locate and clamp workpiece 5 by its circular recess. Workpiece 5 is released when piston 1 is moved to the right by spring 6.

4029	**RACK-AND-PINION MECHANISM OF A HYDRAULIC TWO-WAY TABLE DRIVE**	THP Dr



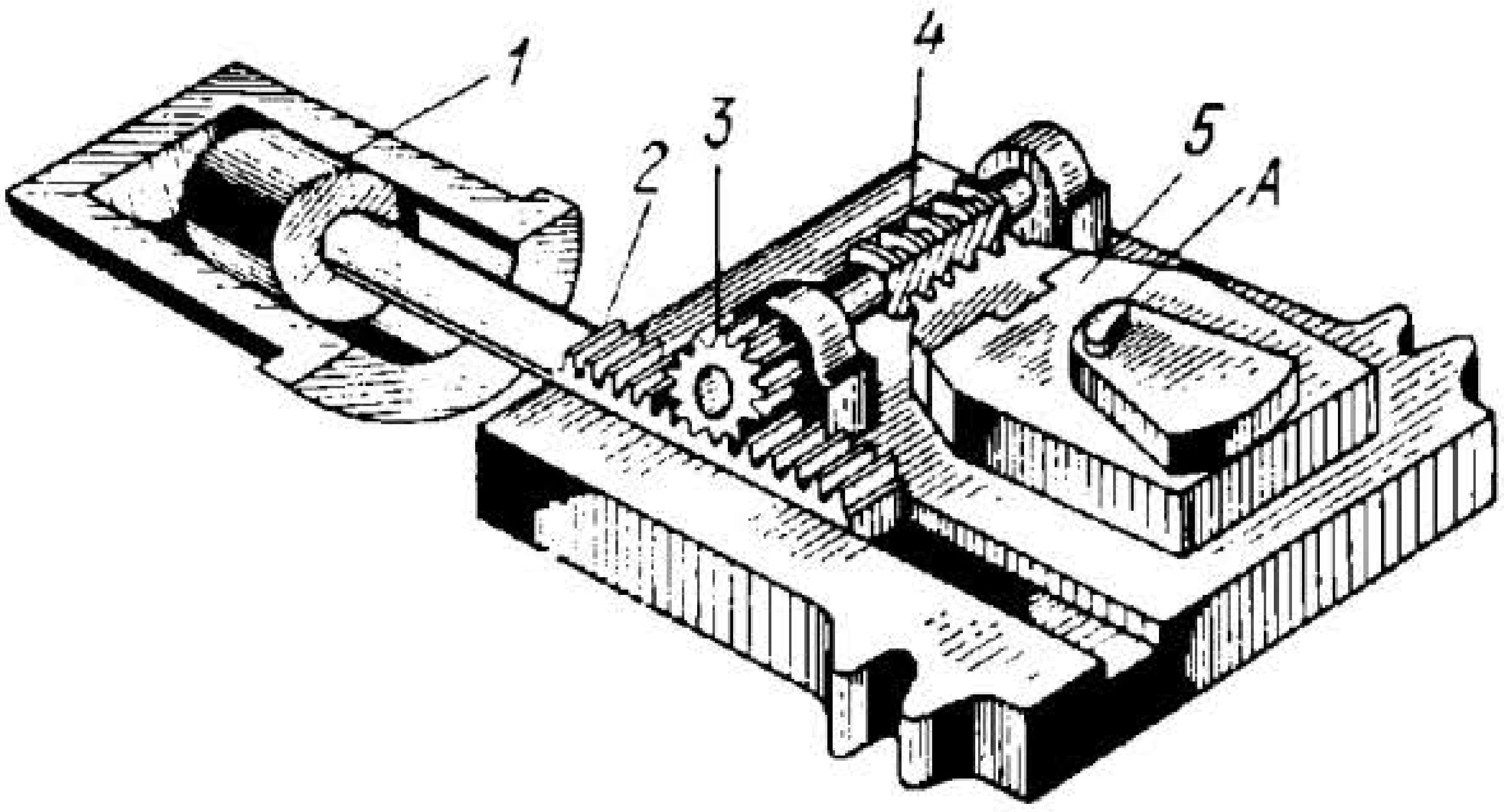
Plunger *1* is reciprocated by the action of fluid delivered to the ends of cylinder *4*. Rack *a* of plunger *1* rotates pinion *2* about fixed axis *A*. Pinion *2* also meshes with gear rack *3* which is secured to table *b* of the machine tool. Table *b* is reciprocated by delivering fluid alternately to ends *c* and *d* of fixed cylinder *4*.

4030	**LEVER-RATCHET MECHANISM WITH A HYDRAULIC DRIVE**	THP Dr



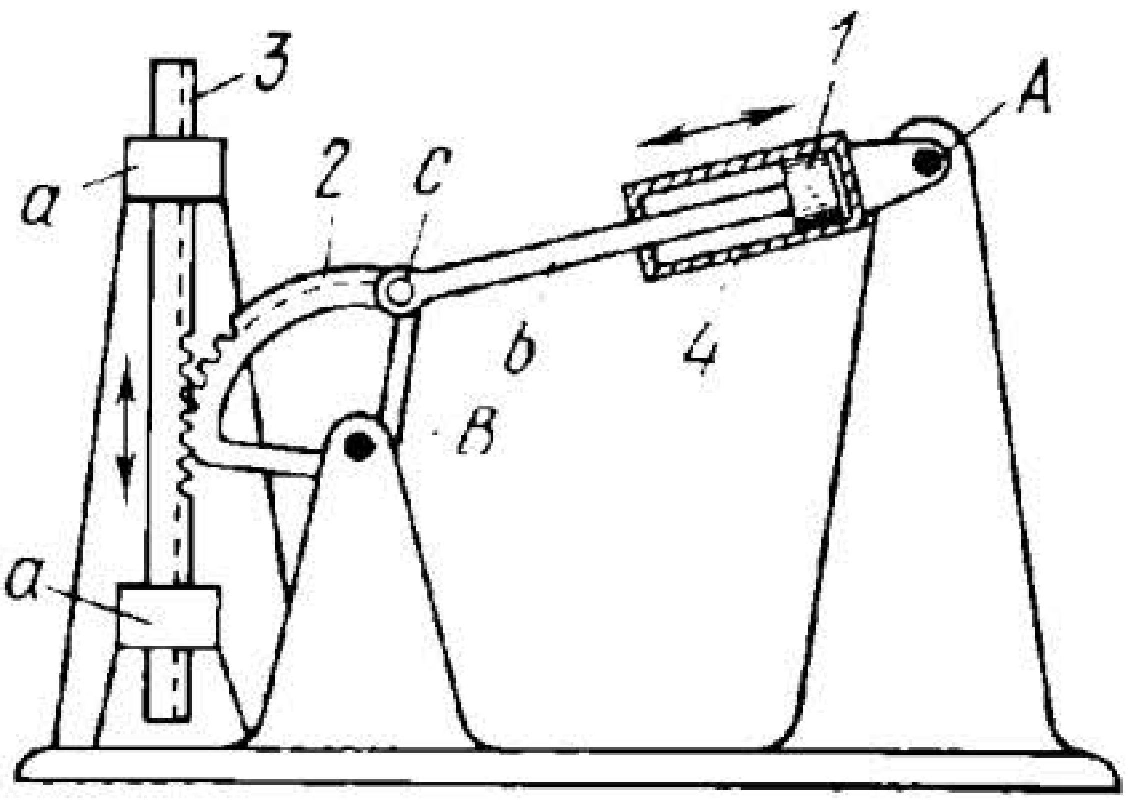
Cylinder *1* turns about fixed axis *A*. Piston *6* reciprocates in the cylinder and is connected by turning pair *B* to lever *7* which turns about fixed axis *C*. Pawls *2* and *3* are connected by turning pairs *E* and *F* to lever *7* and engage ratchet wheel *4* which rotates about fixed axis *O*. When piston *6* is reciprocated by the action of fluid delivered to the ends of cylinder *1*, pawls *2* and *3* rotate ratchet wheel *4* clockwise. Spring *5* serves to keep the pawls in contact with the ratchet wheel.

4031	RACK-AND-PINION HYDRAULIC FEED MECHANISM	THP Dr



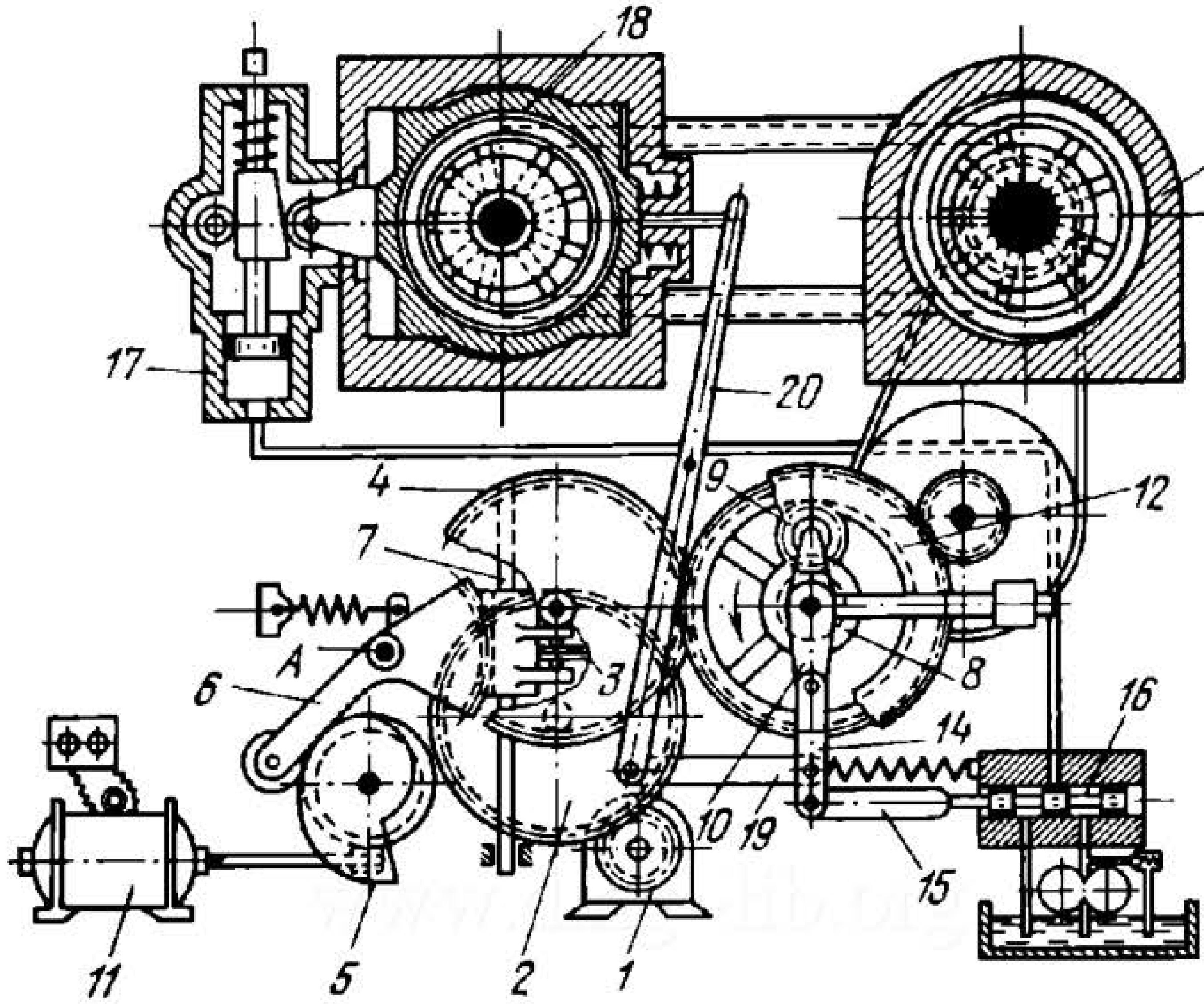
When piston *1* is moved by the action of fluid delivered to the end of its cylinder, its motion is transmitted through gear rack *2*, rigidly attached to the piston rod, pinion *3* and worm *4* to worm wheel segment *5*. Segment *5* turns with the fixture about pin *A* on which the workpiece is located.

4032	RACK-AND-SEGMENT GEAR MECHANISM WITH A HYDRAULIC DRIVE	THP Dr



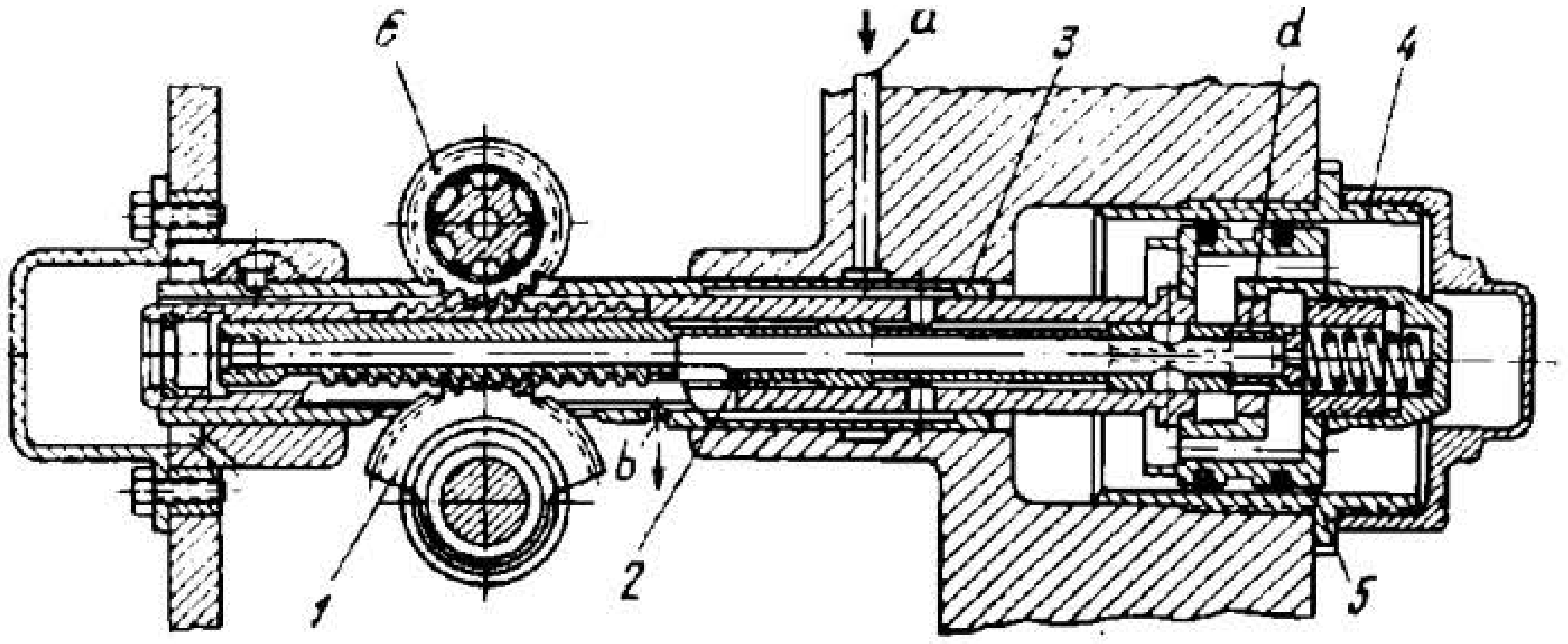
Piston *1* reciprocates in cylinder *4* which turns about fixed axis *A*. Rod *b* of piston *1* is connected by turning pair *C* to segment gear *2* which oscillates about fixed axis *B*. Segment gear *2* meshes with gear rack *3* which reciprocates in fixed guides *a*.

4033	CAM-GEAR MECHANISM OF A HYDRAULIC DRIVE WITH A SYNCHRONIZING DEVICE	THP Dr



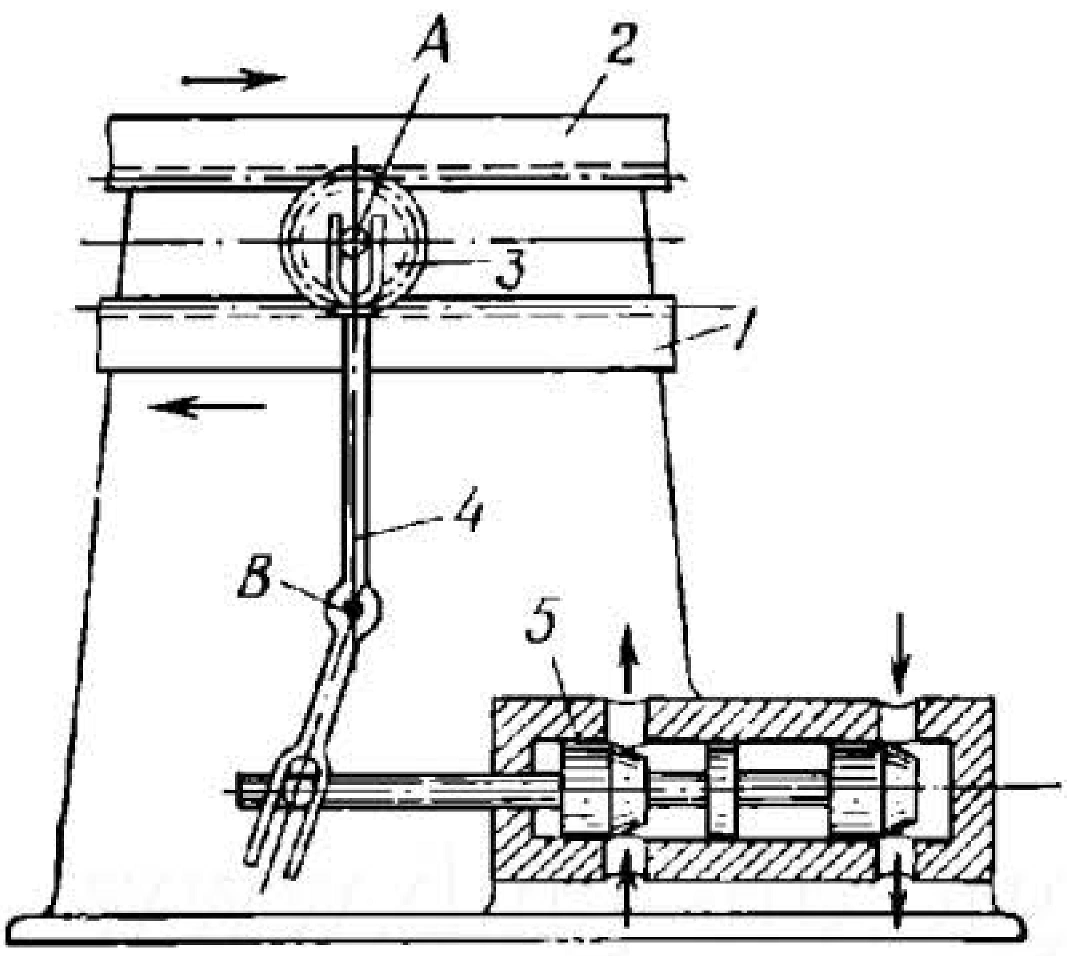
Uniform rotation is transmitted from standard motor *1* through gearing to plate *2* of a friction drive and further, through roller *3* to disk *4*. The speed of disk *4* is varied by electric motor *11* which turns cam *5* through worm gearing. Cam *5*, by means of lever *6*, carrying a segment gear and turning about fixed axis *A*, moves gear rack *7* which meshes with the segment gear and carries roller *3*. Motion of roller *3* varies the transmission ratio of the friction drive and, consequently, the speed of disk *4*. Rotation of disk *4* is transmitted through gearing to sun gear *8* which meshes with planet gear *9*. Gear *9* is mounted on lever *10* which turns freely on the shaft of gear *8*. Planet gear *9* also meshes with the internal teeth of gear *12*, having twice as many teeth as gear *8*. Gear *12* is driven by hydraulic motor *13* through a chain drive and a gear meshing with the external teeth of gear *12*. The transmission ratio of the planetary mechanism is selected so that the angular velocity of gear *8* is twice that of gear *12* and the axis of planetary gear *9* is stationary. Upon a variation in speed of hydraulic motor *13*, lever *10* turns and, through levers *14* and *15*, shifts valve spool *16*. Spool *16* controls fluid delivery to the cylinder with piston *17* which varies the delivery of hydraulic pump *18*. To eliminate fluctuations of the valve spool upon deviations from the established speed, levers *19* and *20* close the valve.

4034	RACK-AND-PINION MECHANISM OF AN AMPLIFYING SERVOSYSTEM	THP Dr



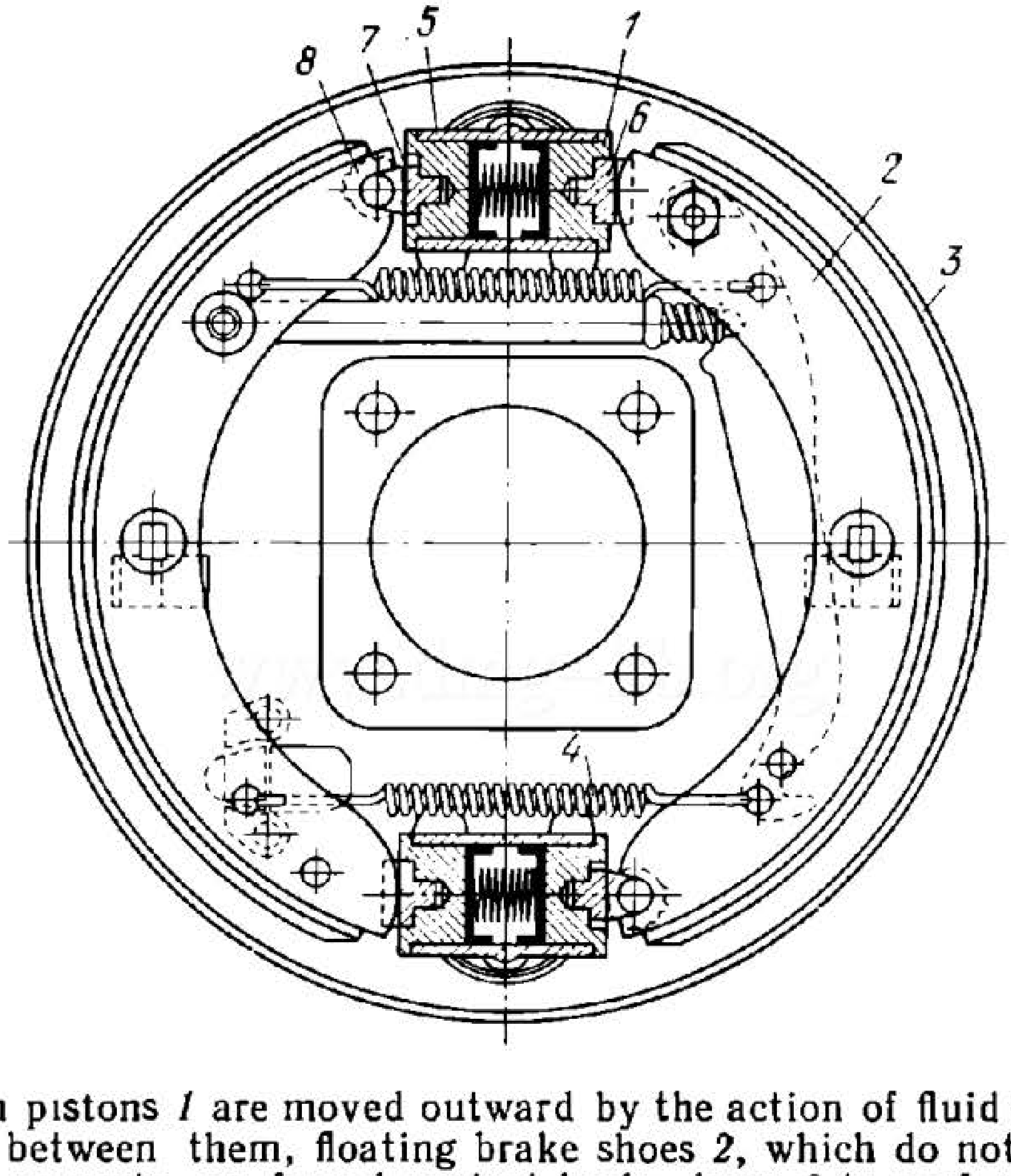
When driving segment gear *1*, meshing with the rack of valve spool *2*, is turned, spool *2* is shifted to the right or left of the neutral position (as shown). This admits fluid under pressure into the system through passage *a*, the holes in guide sleeve *3* and passages and grooves to annular groove *d* of the spool. Depending upon the position of valve spool *2*, fluid is delivered to one of the ends of cylinder *4*. This moves piston *5*, and the rack teeth on the piston rod turn driven gear *6* in the corresponding direction. Fluid from the exhaust end of cylinder *4* is discharged through the axial hole in spool *2* and port *b*.

4035	RACK-AND-PINION MECHANISM OF A SERVOSYSTEM	THP Dr



Rack *1* is mounted on the travelling slide of the machine tool. Rack *2* is imparted the speed at which the slide should travel. When the two racks travel at the same speed, axis *A* of pinion *3*, meshing with both racks, remains stationary. When the slide travels faster than required, the axis of pinion *3* is displaced to the left, turning lever *4* about fixed axis *B* and shifting member *5* of the flow-control valve to the right. This reduces fluid flow to the power cylinder of the slide, decreasing slide speed. When the slide travels slower than required, the axis of pinion *3* is displaced to the right, member *5* is shifted to the left and the flow of fluid to the power cylinder increases.

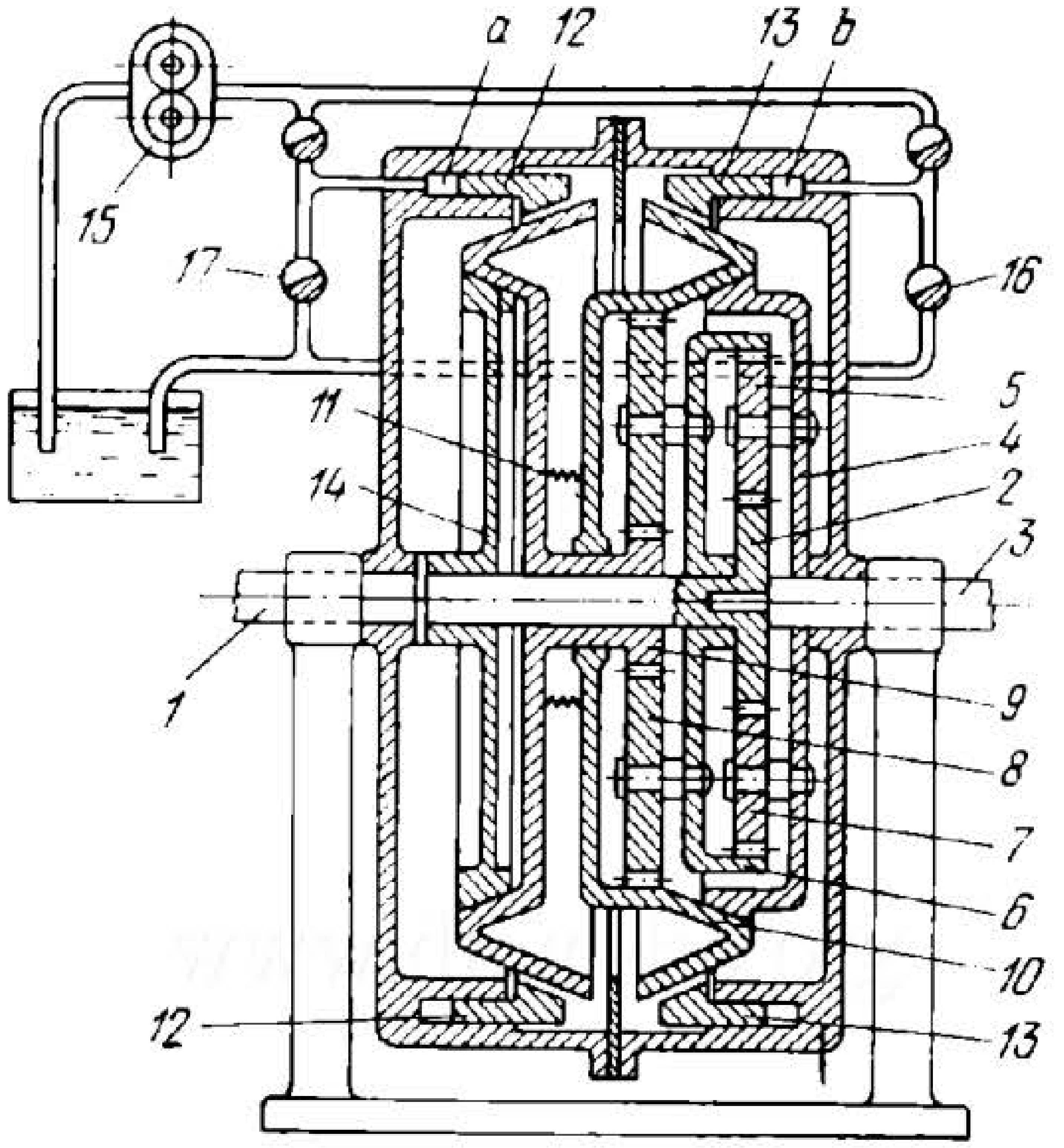
4036	TOOTHED MECHANISM OF A HYDRAULIC BRAKE WITH FLOATING SHOES	THP Br



When pistons *1* are moved outward by the action of fluid delivered between them, floating brake shoes *2*, which do not have rigid supports, are forced against brake drum *3* to perform the braking operation. Shoes *2* are held together by two extension springs *4* and bear against inserts *6* of pistons *1* which have flanges that rest upon the end faces of cylinders *5*. At its outer end, one of each set of two pistons *1* has attached fork *7* in whose slot sprocket *8* with eccentric trunnions can slide. The clearance between the shoes and the brake drum can be adjusted by turning sprocket *8*.

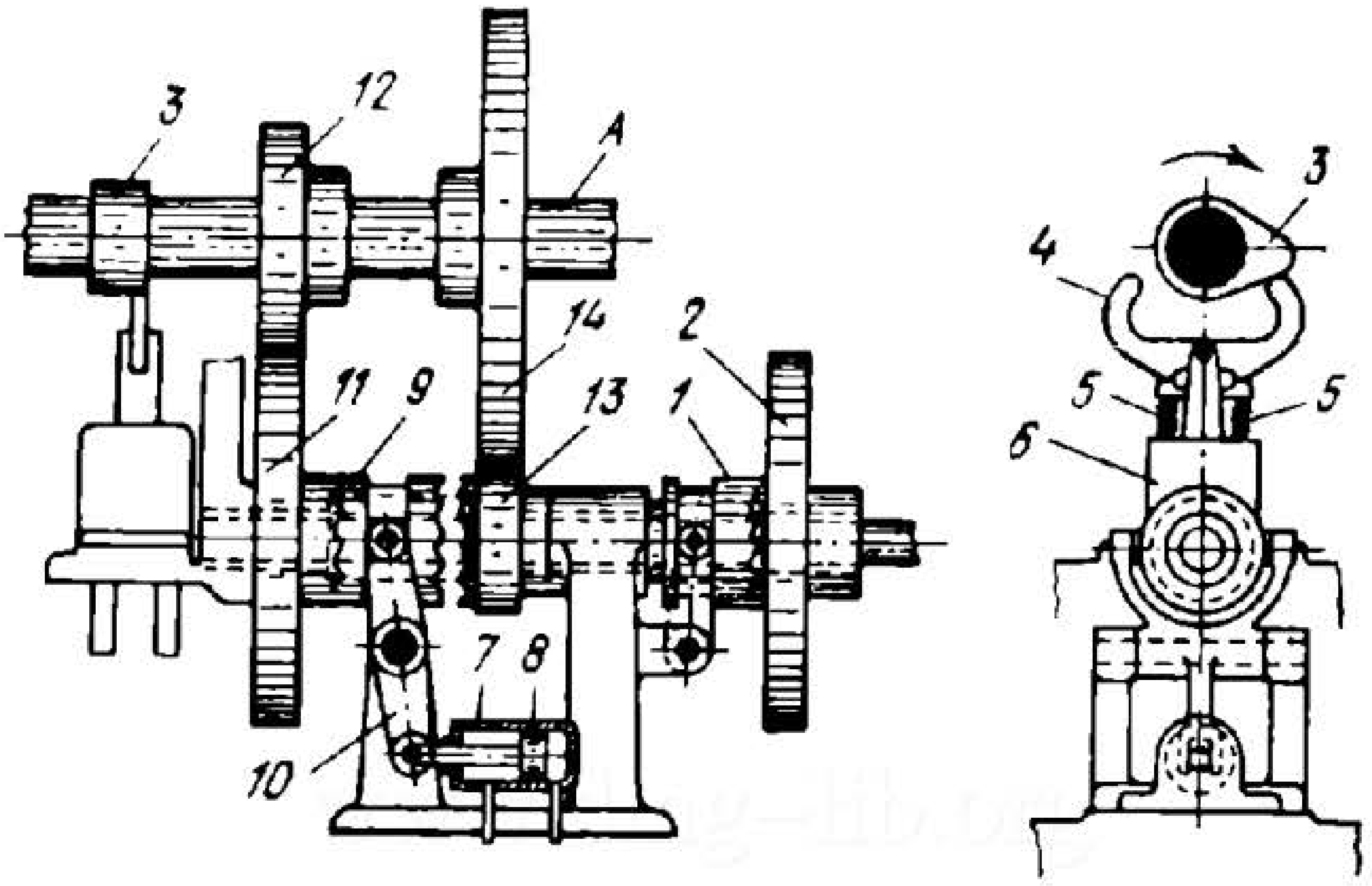
7. SPEED-CHANGE AND REDUCING GEAR MECHANISMS (4037 and 4038)

4037	GEAR-FRICTION PLANETARY MECHANISM OF A FOUR-SPEED GEARBOX	THP SR



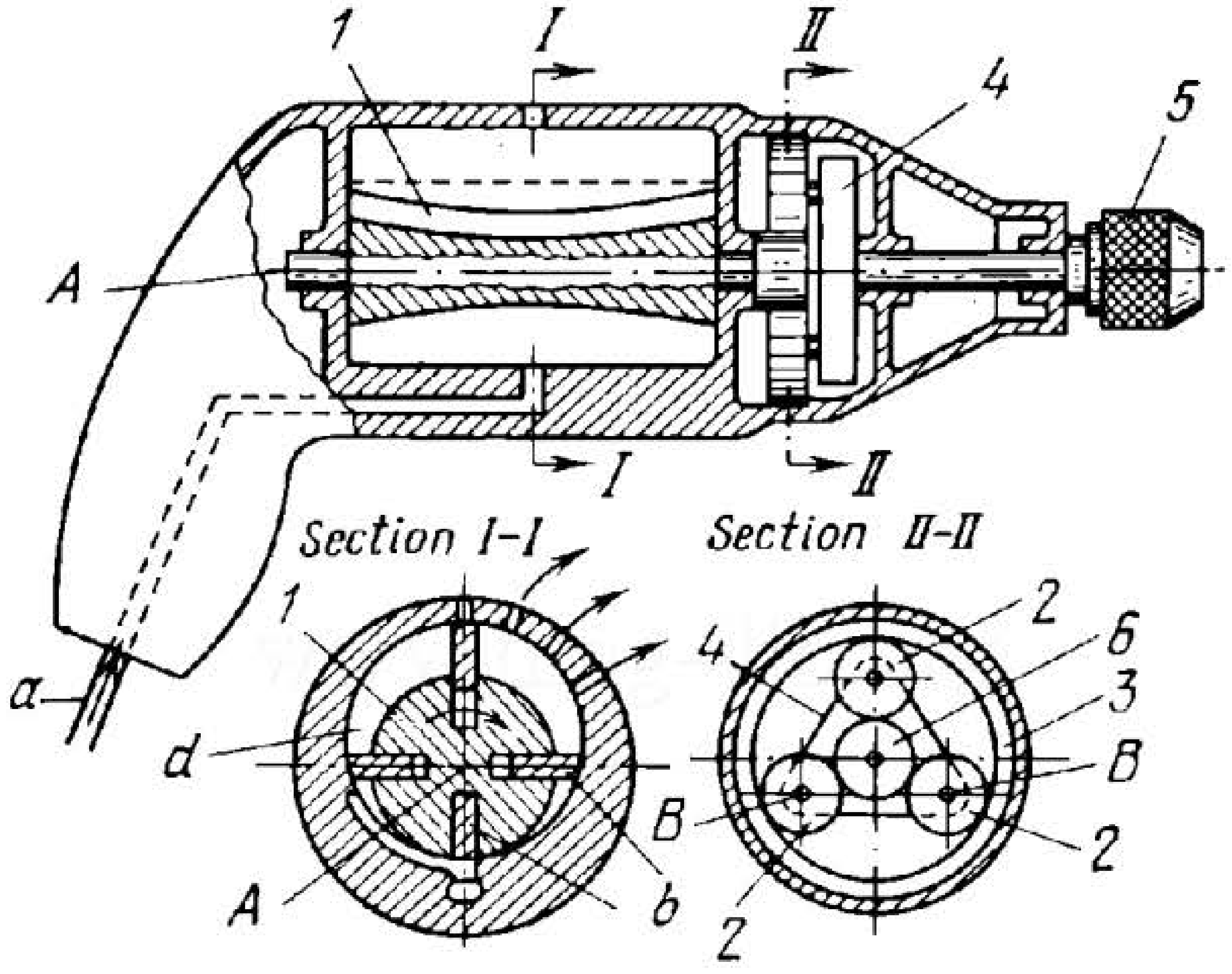
Pump *15* delivers fluid into chambers *a* and *b*, shifting rings *12* and *13* inward into contact with the friction surfaces of sun wheels *9* and *10*. At this, sun wheel *9* is shifted to the right, out of contact with friction wheel *14* which is rigidly mounted on driving shaft *1*. Sun wheel *10* is shifted to the left, out of contact with carrier *4* which is rigidly mounted on driven shaft *3*. As a result, wheels *9* and *10* stop rotating. Internal sun gear *6* and planet gears *8* are also stationary. Rotation of the driving shaft is transmitted by gear *2* to planet gears *5* and carrier *4*. This drives the driven shaft at minimum speed. To obtain the second speed, fluid is drained from chamber *a* through discharge valve *17* to the tank. Sun wheel *10* remains stationary, and wheel *9* is shifted to the left by springs *11* into contact with tapered friction wheel *14*. Owing to friction, wheel *9* rotates together with wheel *14*. The rotation of driving shaft *1* is transmitted by two sets of planetary gearing to driven shaft *3*. The speed of the driven shaft is higher than in the first case. To obtain the third speed, valve *17* is closed and valve *16* is opened. Ring *12* is shifted by the action of fluid in chamber *a* and it brakes wheel *9*. Wheel *10* is shifted to the right by springs *11* into contact with the friction surface of carrier *4* and rotates together with the carrier. The rotation of driving shaft *1* is transmitted by sun gear *2* and planet gears *5* to internal gear *6*. From gear *6* rotation is transmitted further to planet gears *8* and sun gear *10*. The speed of driven shaft *3* is higher than in the preceding case. To obtain the maximum speed, pump *15* is switched off. Wheels *9* and *10* are shifted outward by springs *11* into contact with tapered friction wheel *14* and with carrier *4*. At this, sun wheel *6* rotates at the speed of the drive motor.

4038	CAM-GEAR MECHANISM FOR PERIODIC SPEED CHANGING	THP SR



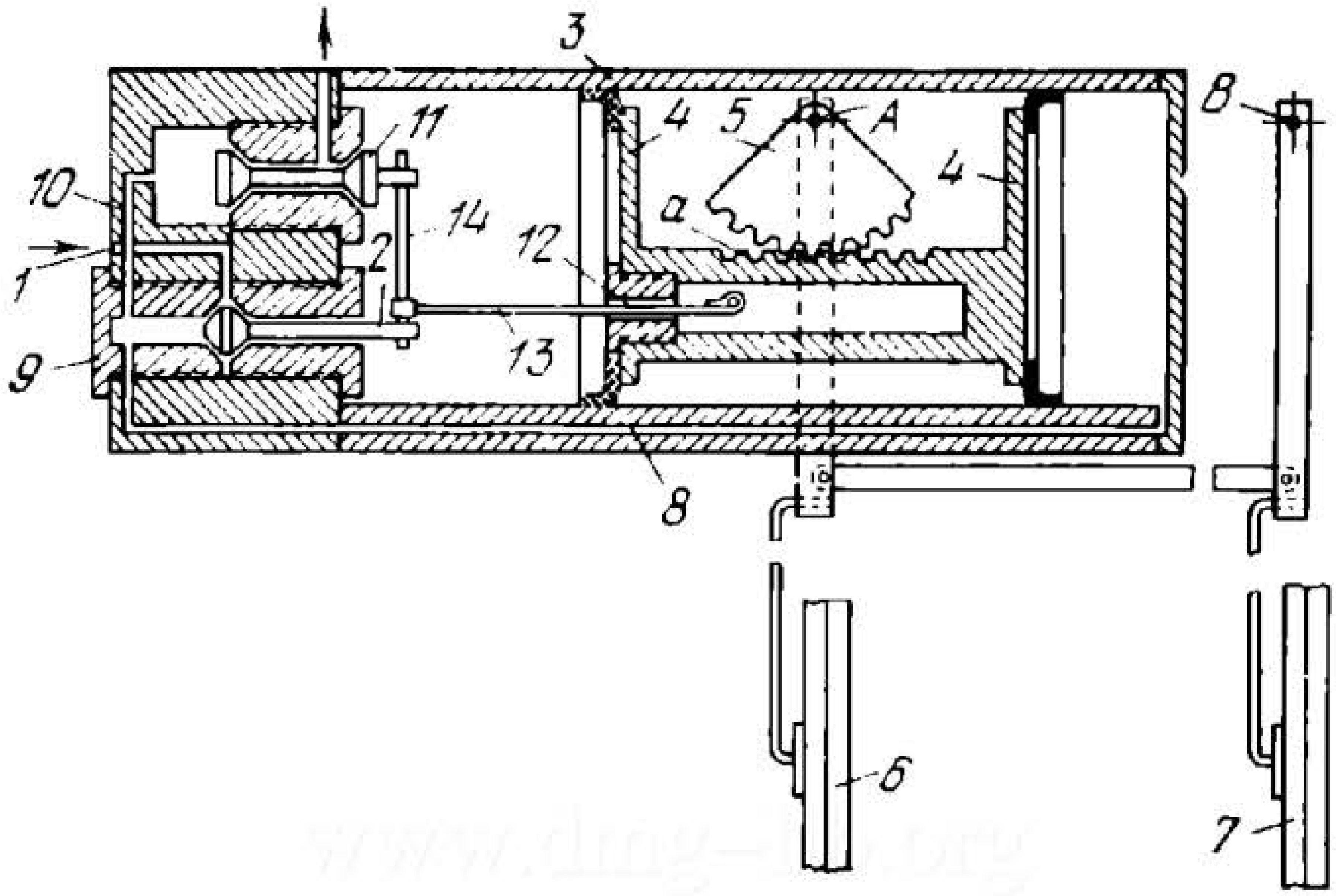
The mechanism is started and stopped by means of clutch *1* which engages and disengages gear *2* whose rotation is transmitted to shaft *A*. Keyed to shaft *A* is cam *3* which actuates lever *4*. As lever *4* turns in either direction it depresses one of plungers *5* of pneumatic directional valve *6*. Air admitted into one of the ends of cylinder *7* moves piston *8* toward the other end. At this, lever *10* shifts clutch member *9* in one or the other direction. In the left-hand position of clutch member *9*, shaft *A* is imparted a higher speed through gears *11* and *12*, and in the right-hand position, through gears *13* and *14*, the speed of shaft *A* is lower.

4039	PLANETARY GEARING MECHANISM OF A PORTABLE PNEUMATIC DRILL	THP FD



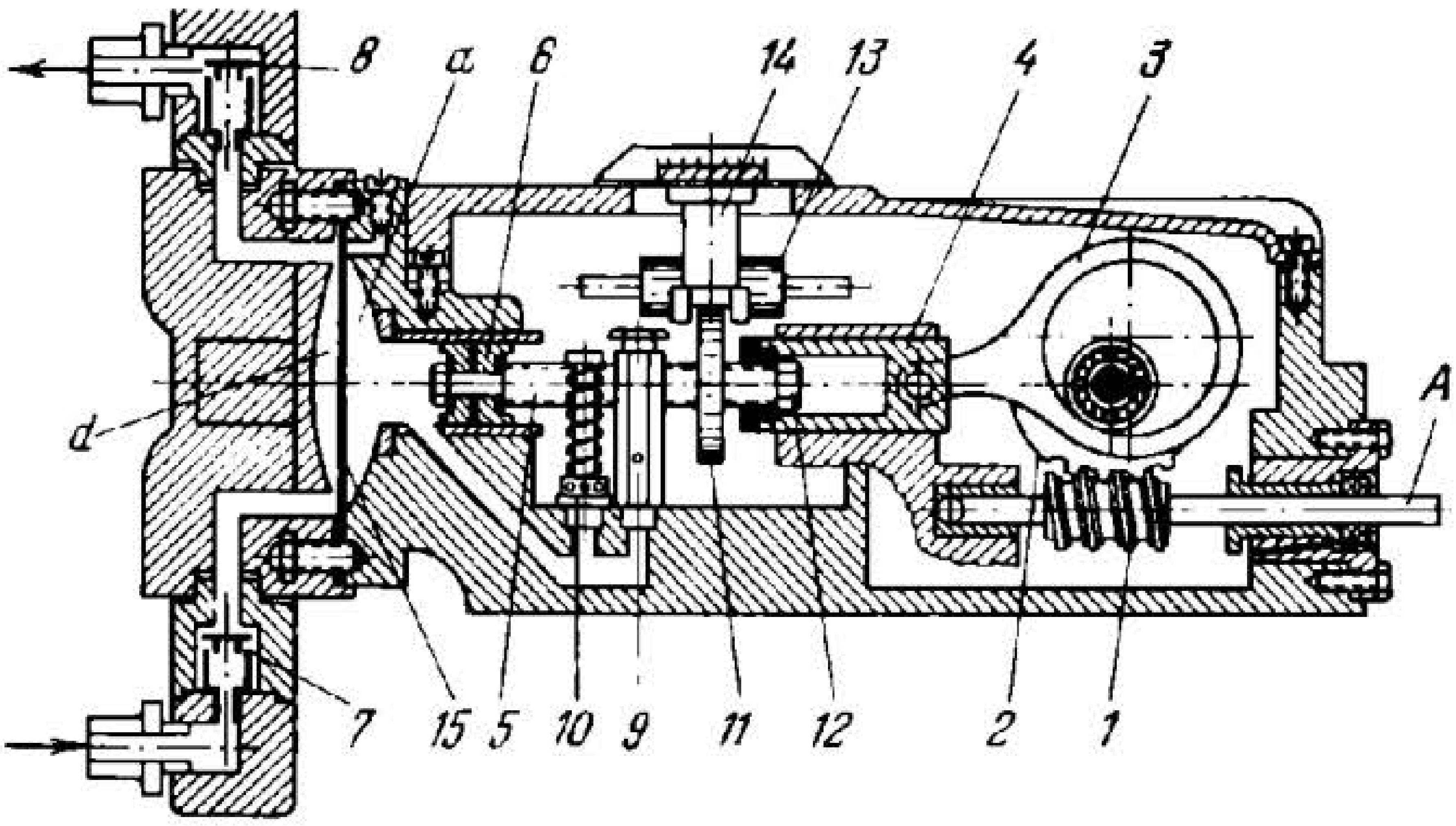
Rotor *1* rotates about fixed axis *A* and has four vanes *b* which slide in slots of rotor *1* and are held by centrifugal force against the wall of cylindrical chamber *d* whose axis is located eccentrically with respect to axis *A*. Sun gear *6*, rigidly mounted on the shaft of rotor *1*, meshes with three planet gears *2* which, in turn, mesh with internal gear *3*, rigidly secured to the body of the drill. Planet gears *2* rotate about axes *B* of carrier *4* which is rigidly mounted on drill spindle *5*. Air admitted through hose *a* rotates four-vane rotor *1* whose rotation is transmitted through planetary gearing to spindle *5*.

RACK-AND-PINION MECHANISM OF A PNEUMATIC WINDSHIELD WIPER



When compressed air is admitted through passage *1* and valve *2* to the left end of cylinder *3*, pistons *4*, rigidly attached together, are moved to the right. At this, rack *a* turns segment gear *5* and its shaft *A* on which blade *6* is rigidly mounted. This also turns blade *7*, linked to blade *6*, about fixed axis *B*. Air from the right end of cylinder *3* is exhausted through passages *8* and *10* and valve *11* to the atmosphere. As piston *4* travels to the right, sleeve *12* shifts the shank of link *13* which is attached to crosspiece *14*, joining valve members *2* and *11*. This moves the valve members to the right. Now, compressed air admitted through passage *1* flows through nipple *9* and passage *8* to the right end of cylinder *3*, swinging blades *6* and *7* in the opposite direction. Air from the left end of the cylinder is exhausted through valve *11* to the atmosphere.

4041	WORM GEARING OF A METERING PUMP	THP FD

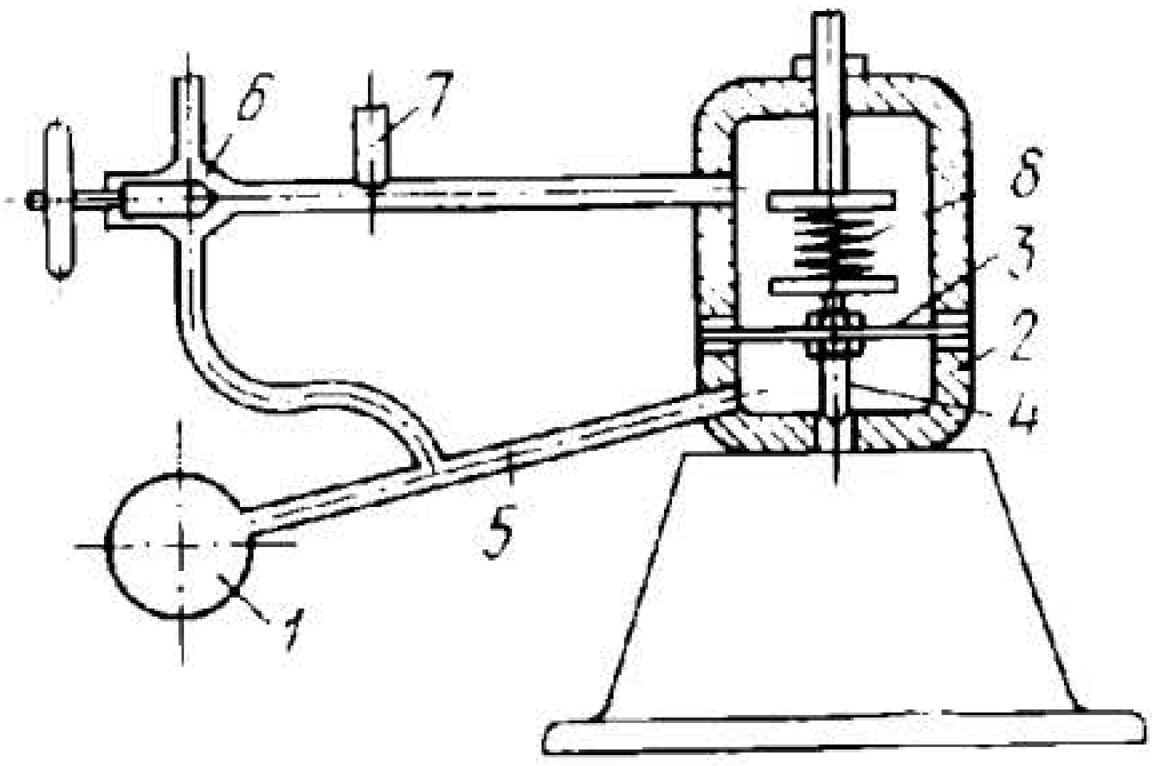


When shaft *A* rotates, motion is transmitted through worm *1*, worm wheel *2* and connecting rod *3* to slider *4*, piston rod *5* and piston *6*. Space *a* between piston *6* and membrane *15* is filled with fluid. As piston *6* travels to the right a vacuum is set up in space *a* and membrane *15* is bent to the right. This sets up a vacuum in chamber *d* into which the fluid to be metered is drawn through valve *7*. As piston *6* travels to the left, membrane *15* is bent to the left, forcing out the metered fluid through valve *8* into the discharge pipeline. The accuracy of pump delivery is maintained by the provision of special valve *9* which by-passes fluid into space *a*, replenishing leakage losses. Relief valve *10* protects the system against overloads by releasing fluid from space *a*. The amount of fluid fed in each stroke can be varied without stopping the pump as follows: as slider *4* travels to the left, a part of its stroke is idle until it reaches gear *11*, mounted on the threaded portion of piston rod *5*. In its travel to the right, a part of the stroke of slider *4* is also idle until its cover reaches nut *12* which is screwed on the end of piston rod *5*. The amount of idle travel of the slider (and dwell of rod *5*) depends upon the distance between gear *11* and nut *12* which can be adjusted by turning gear *13*, meshing with gear *11*. The position of gear *11* on rod *5* is registered by indicator *14* which shows the length of the piston stroke on a scale.

SECTION THIRTY-ONE

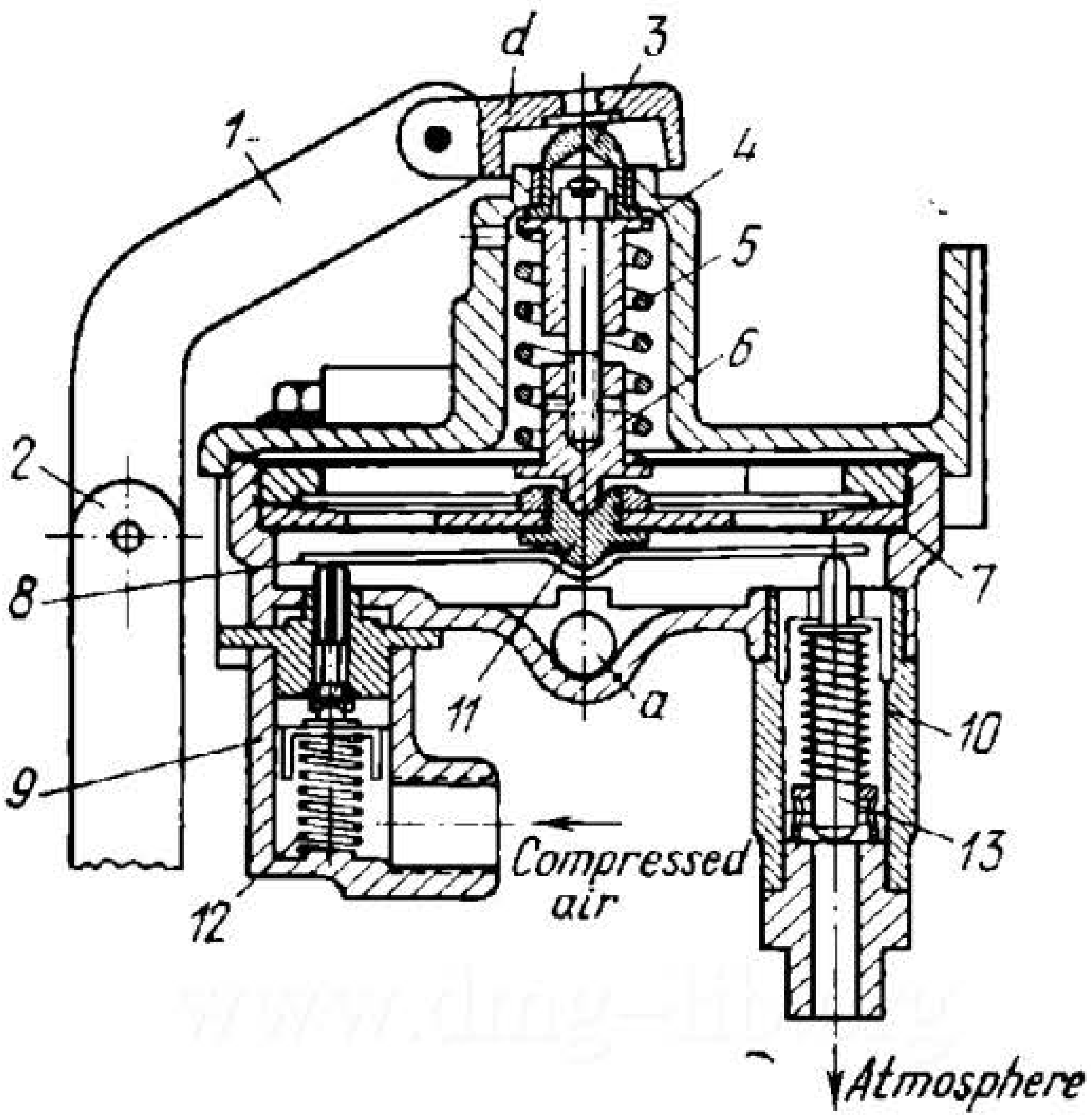
Elastic-Link Hydraulic and Pneumatic Mechanisms EHP

4042	RELIEF VALVE MECHANISM WITH AN ELASTIC DIAPHRAGM	EHP Va



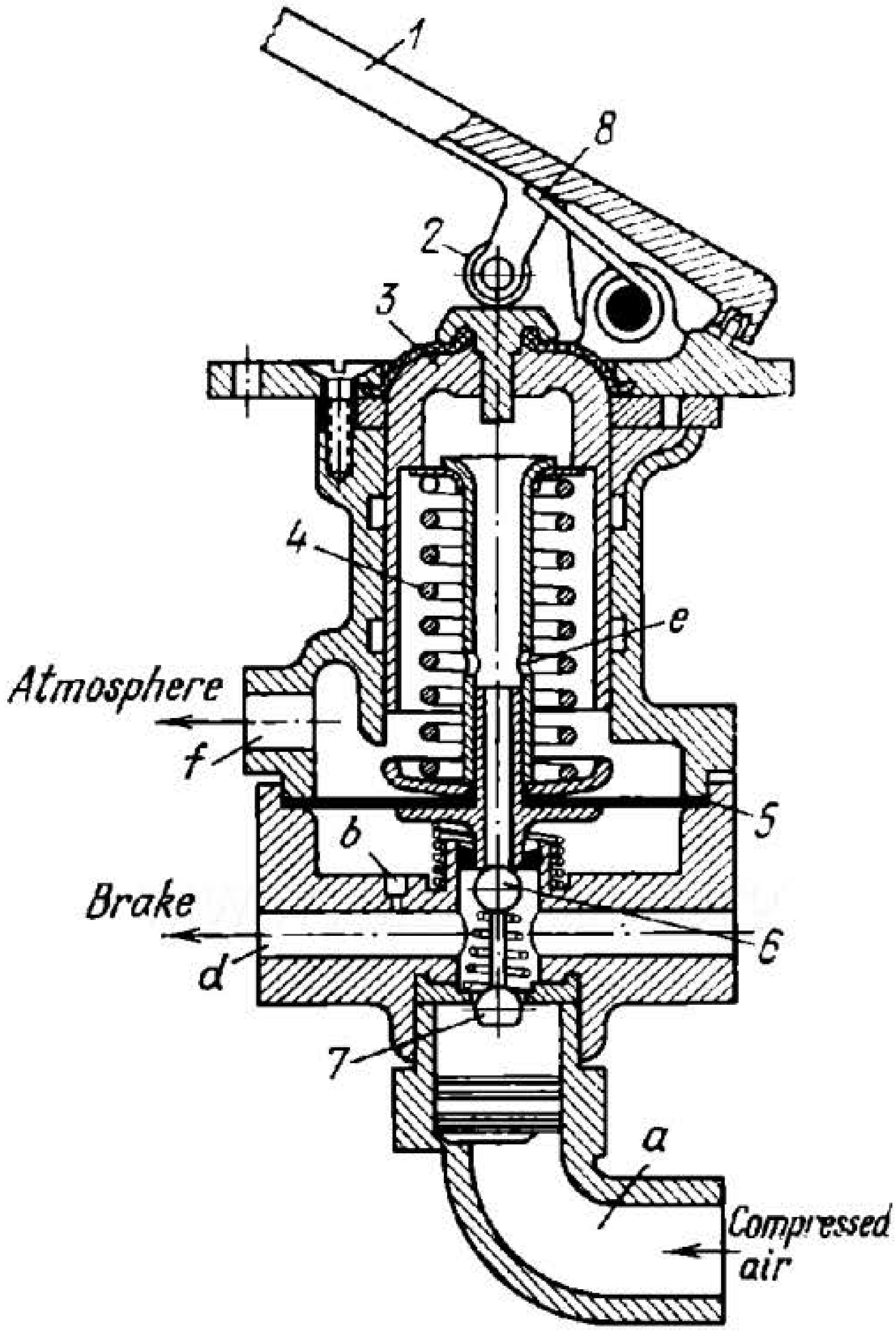
The mechanism is intended for maintaining constant speed of a machine tool table regardless of the load (cutting variables). Pump *1* delivers fluid through flow-control valve *6* and pipeline *7* to the power cylinder whose piston is linked to the table. The upper chamber in housing *2* of the relief valve is connected to pipeline *7*, and the lower chamber to pump *1* through pipeline *5*. Housing *2* contains diaphragm *3* subject to the constant pressure of spring *8*. Provided in the lower chamber of housing *2* is an orifice into which needle valve member *4* enters. If the load on the piston of the power cylinder increases at a constant setting of flow-control valve *6*, the pressure of the fluid in the system increases, as it does in the upper chamber of housing *2*. This bends diaphragm *3* downwards moving needle member *4*, attached to the diaphragm, into the discharge orifice, thereby increasing the amount of fluid delivered by the pump into pipeline *7*. As a result, the speed of the piston and table is automatically equalized. Table speed is varied by flow-control valve *6*. If valve *6* is closed to some extent, the pressure in the lower chamber of housing *2* increases, diaphragm *3* is bent upward, opening the discharge orifice. When flow-control valve *6* is opened, the discharge orifice is closed.

4043	**LEVER MECHANISM OF A BRAKE VALVE WITH AN ELASTIC DIAPHRAGM**	EHP Va



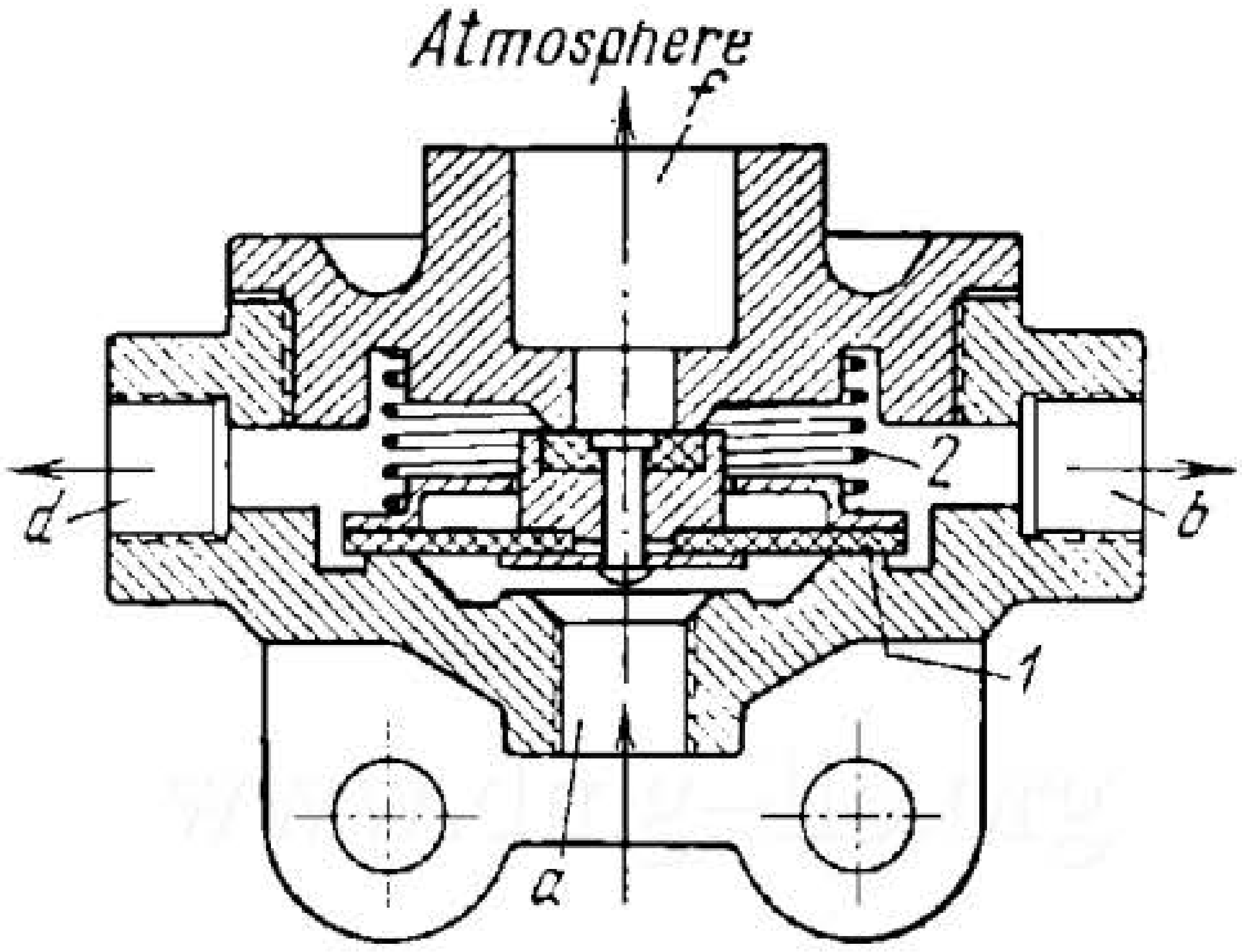
Lever *1*, rigidly secured to lever *d*, is linked by tie-rod *2* to the brake pedal. The force exerted on the pedal is transmitted through lever *1*, plunger *3*, sliding sleeve *4*, spring *5* and its thrust member *6* to diaphragm *7* whose shaped nut *11* rests on plate *8*. The edges of plate *8* rest on the stems of input valve *9*, connected to the tank, and discharge valve *10*, connected to the atmosphere. When the brake pedal is released, the input valve is closed and the open discharge valve connects the space under diaphragm *7* with the atmosphere. This space is connected through passage *a* to the brake chambers of the wheels (of an automobile). When the brake pedal is depressed, plate *8* opens input valve *9* and closes discharge valve *10*. Compressed air from the tank is admitted through valve *9* and passage *a* into the brake chambers, producing the braking action. The pressure under diaphragm *7* increases, bending the diaphragm upward and compressing spring *5*. Plate *8* follows the diaphragm. Since spring *12* of the input valve is taken several times stronger than spring *13* of the discharge valve, the input valve is closed and the discharge valve remains closed. If the brake pedal remains in a constant position, a certain constant pressure is maintained in the brake chambers. If the pressure on the pedal is increased, a new amount of compressed air is delivered from the tank, the pressure in the brake chambers increases as does the braking action. If the pressure on the pedal is reduced, diaphragm *7* bends upward, the discharge valve is opened to some extent, and the pressure in the space under the diaphragm, as well as in the brake chambers, is reduced because a part of the air is released into the atmosphere. This reduces the braking action. When the pedal is released, spring *5* returns it to its initial position, diaphragm *7* is bent upward, input valve *9* remains closed, and discharge valve *10* is completely opened. This releases the brakes.

4044	LEVER MECHANISM OF A BRAKE VALVE WITH AN ELASTIC MEMBRANE	EHP Va



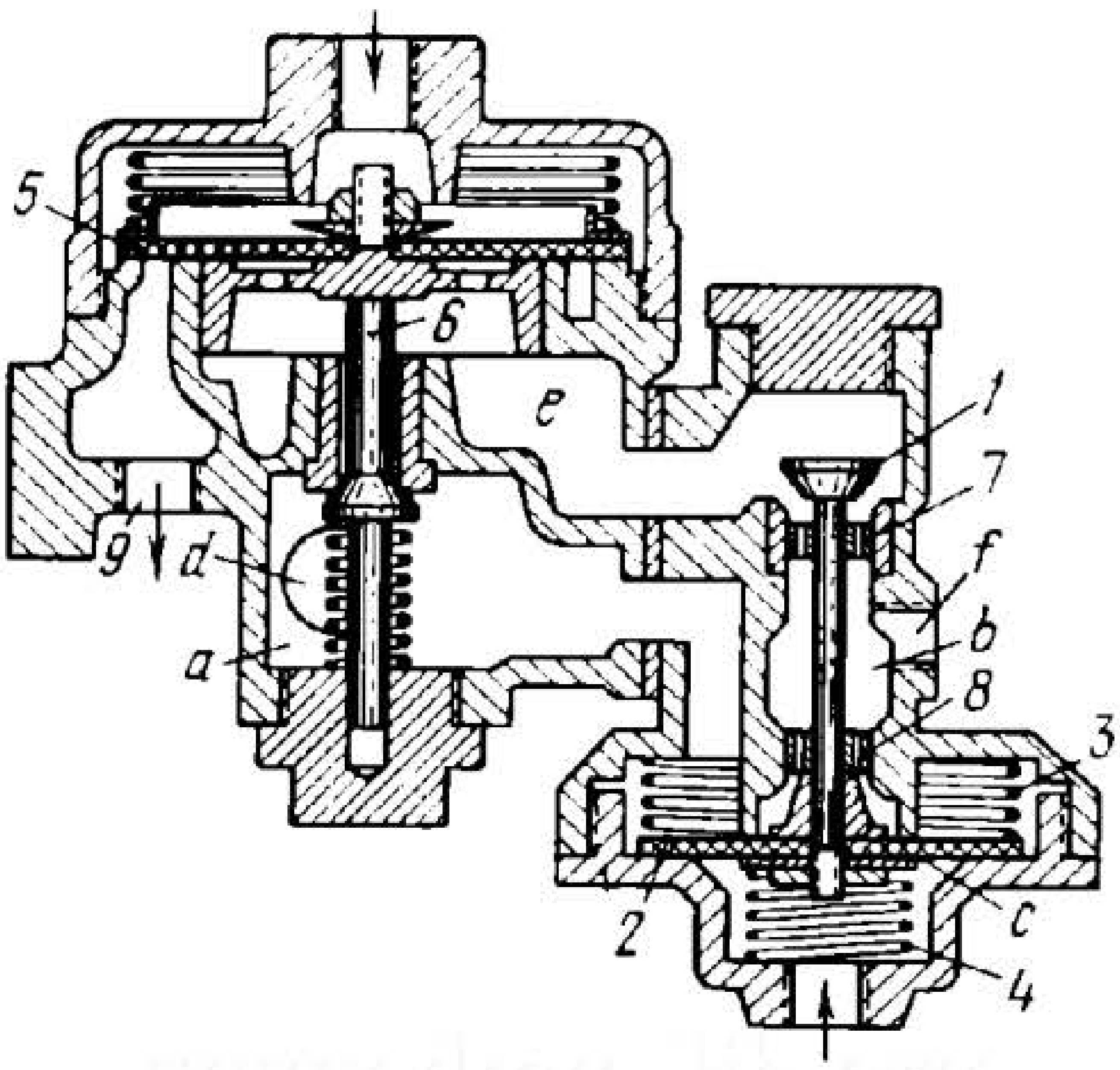
When brake pedal *1* is depressed, roller *2* depresses plunger *3*, compressing spring *4*. The force of spring *4* bends membrane *5* downward. This closes discharge valve *6* (which is not completely closed in the initial position of the membrane) and opens input valve *7*. Compressed air from the tank is admitted through passage *a* and is delivered to the brake cylinders through passage *d*, producing the braking action. At the same time, pressure in passage *d* is transmitted through orifice *b* into the space under membrane *5*. If pedal *1* is held in the depressed position, membrane *5* takes up a position in which both valves are closed and the pressure in the brake cylinders is constant. When released, pedal *1* is returned to its initial position by spring *8*, and plunger *3*, by spring *4*. At this, membrane *5* is bent upward, opening discharge valve *6* and closing input valve *7*. Air from the brake cylinders is discharged to the atmosphere through passage *e* in the stem of the membrane and port *f*. This releases the brakes.

4045	RAPID BRAKE RELEASE VALVE MECHANISM WITH AN ELASTIC DIAPHRAGM	EHP Va



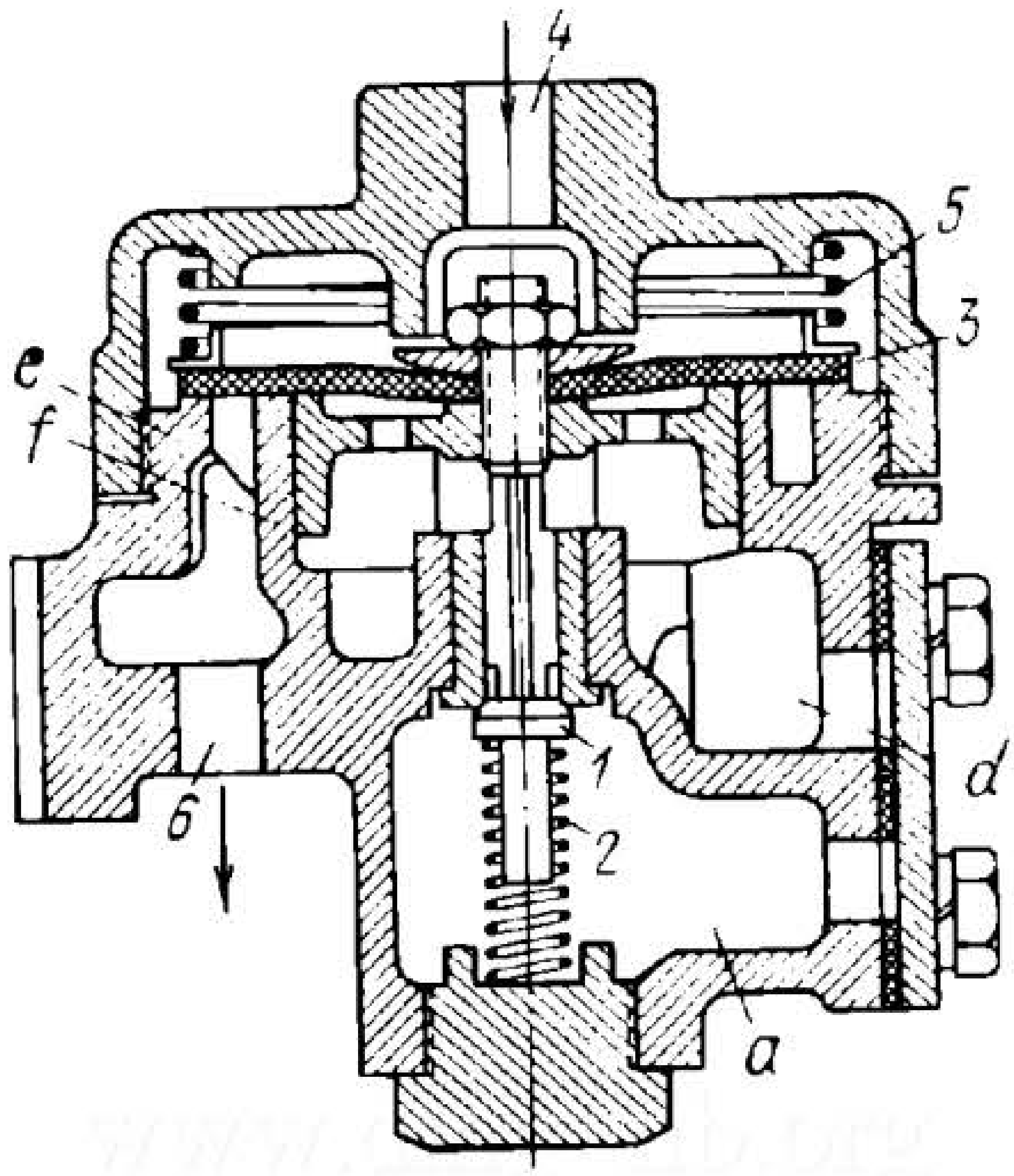
When compressed air is delivered from the brake valve to port *a*, rubber diaphragm *1* is raised and the air is directed through ports *d* and *b* to the brake chambers. At the same time, diaphragm *1* closes off air discharge to the atmosphere. When braking has been completed, the pressure under diaphragm *1* drops rapidly and the diaphragm is bent downward by the pressure of the air in the brake chambers and by spring *2*. This closes port *a* and opens port *f*, allowing the air to escape to the atmosphere, by-passing the brake valve. As a result, the brakes are more rapidly released.

4046	TRUCK-TRAILER COMBINATION EMERGENCY VALVE MECHANISM WITH AN ELASTIC DIAPHRAGM	EHP Va



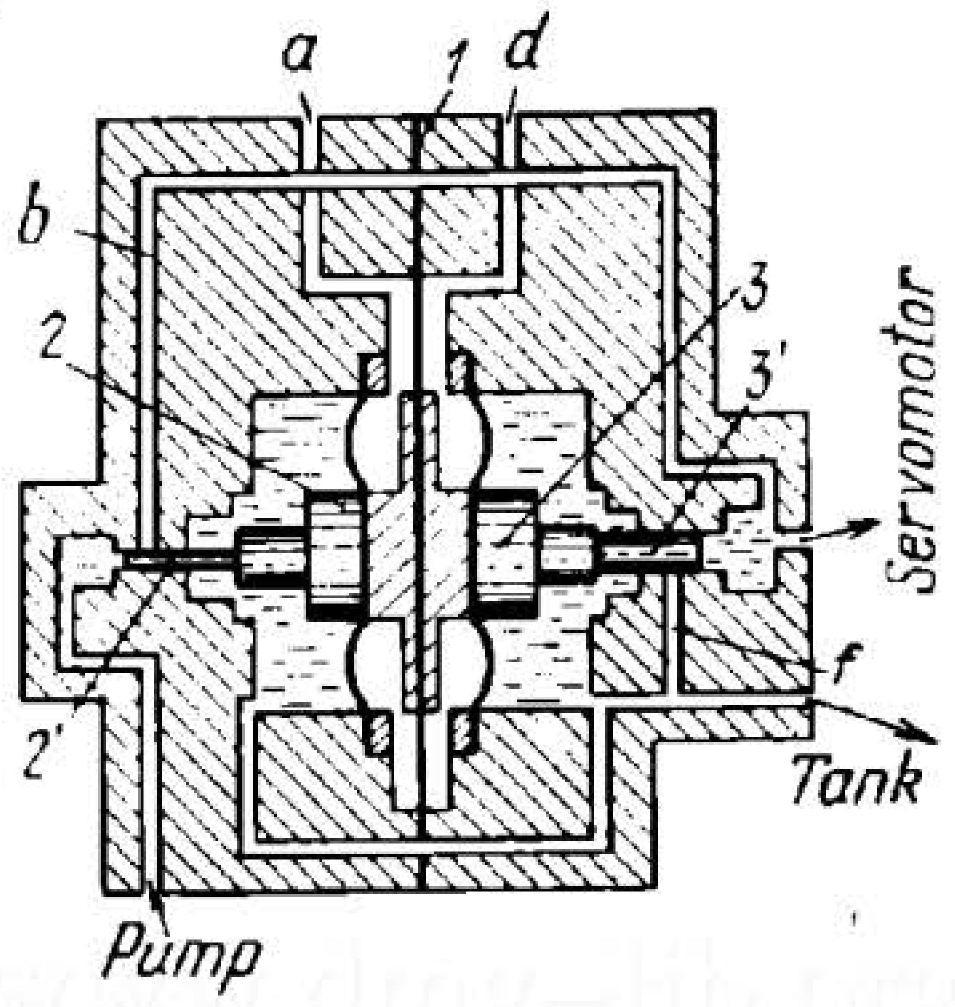
Valve member *1* is linked by its stem to diaphragm *2* which is held down by spring *3* to the valve housing. Spring *4* tends to lift diaphragm *2* and valve member *1* to their upper position. The upper and lower guides of valve member *1* have orifices through which air can pass. Compressed air from the tank of the truck is delivered under diaphragm *2*. Compressed air from the brake valve is delivered to the upper port of the acceleration valve above diaphragm *5*. Chamber *a* of the acceleration valve is connected through port *d* to the auxiliary tank. Chamber *b* of the emergency valve is connected through port *f* to the brake chambers of the rear wheels of the trailers. When the brakes are not applied, compressed air from the main tank raises valve member *1* and the edge of diaphragm *2*, pressing the diaphragm against annular projection *c*. At this, air passes through chamber *a* and port *d* into the auxiliary tank. Chamber *b* is connected to chamber *e* of the acceleration valve. When the brakes are applied, compressed air from the brake valve, acting on diaphragm *5*, opens valve member *6*. This admits air from chamber *a* into chambers *e* and *b*, and, through port *f*, to the brake chambers of the wheels. Chamber *a* is replenished by air, first from the auxiliary tank through port *d* and then, when the pressure in this tank drops to a definite value, from the main tank. In releasing the brakes, when the air pressure in the upper part of the acceleration valve drops, air from the brake chambers is discharged through chambers *b* and *e*, lifting diaphragm *5* slightly. If one or all the trailers break away from the truck, they are braked to a full stop by the emergency valve. Rupture of the pipeline leads to a drop in pressure under diaphragm *2* of the emergency valve. Then the pressure of the air of the auxiliary tank in chamber *a* bends diaphragm *2* downward, moving valve member *1* onto its seat. Chamber *b* is connected to chamber *a*, i.e. the braking action is performed by the supply of air from the auxiliary tank. Closed valve member *1* prevents the air from passing out through diaphragm *5* into the atmosphere. This stops the trailers that have been broken away. The emergency valve operates in conjunction with the acceleration valve.

ACCELERATION VALVE MECHANISM WITH AN ELASTIC DIAPHRAGM



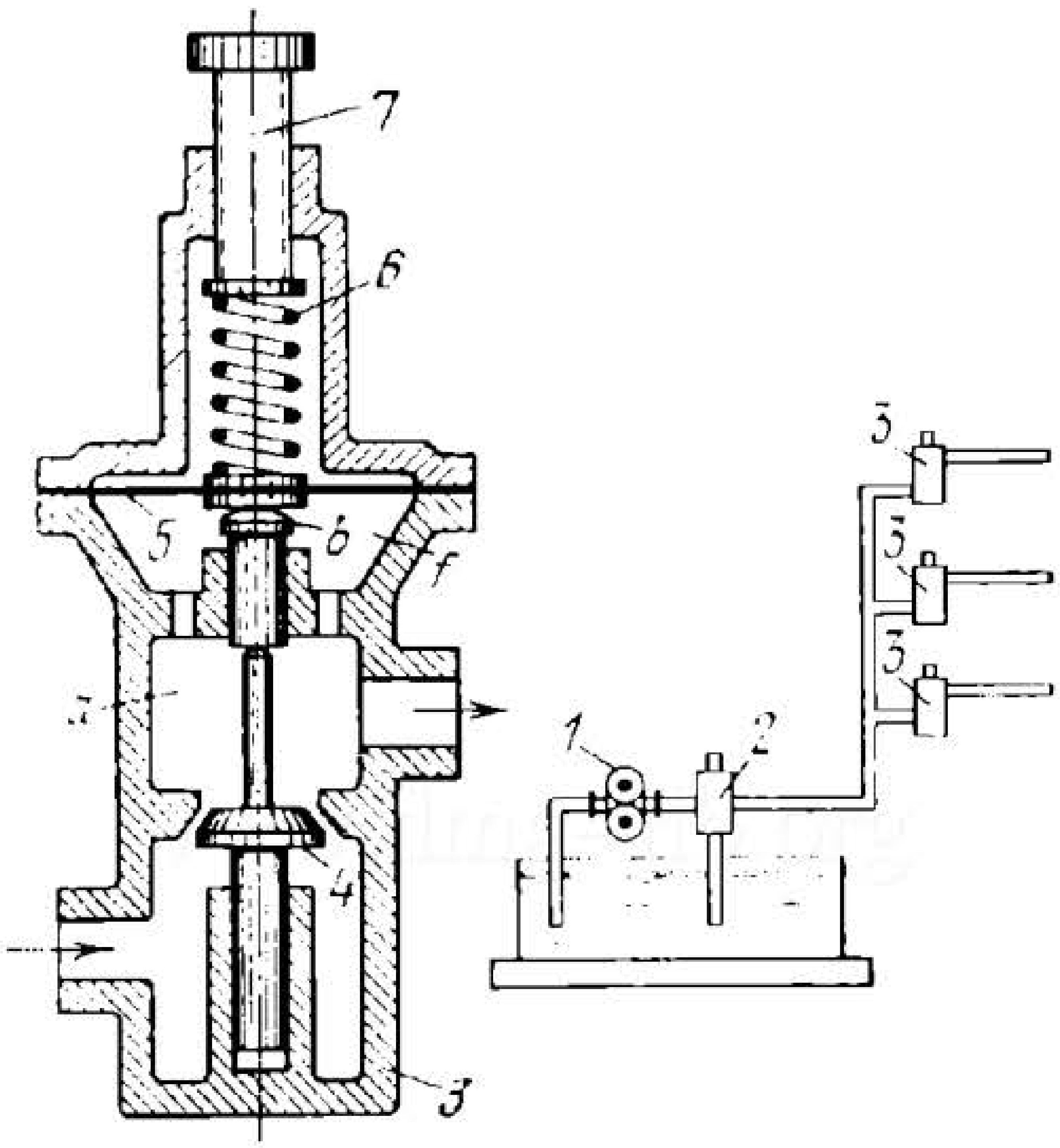
Valve member 1 is held on its seat by spring 2. Space *a* under the valve member is connected to the compressed air tank. When the brake pedal (not shown) is depressed, compressed air is delivered from the brake valve through port 4 and it bends diaphragm 3 downward, thereby opening valve member 1. Compressed air from space *a* passes into space *d* and is delivered to the brake chambers of the rear wheels. At the same time, the compressed air tends to force diaphragm 3 upward. When a definite pressure is reached in the brake chambers, equilibrium is set up between the forces acting above and below the diaphragm. At this, valve member 1 is closed, shutting off further air delivery to the brake chambers. To increase the braking force, it is necessary to apply more force to the brake valve pedal. Then the pressure in the brake valve and, consequently, above the diaphragm is increased, opening valve member 1 again and admitting a new amount of air into the brake chambers. After this, equilibrium is reached again. Diaphragm 3 rests on rings *e* and *f*, and is subject to the action of spring 5. To release the brakes rapidly, the brake pedal is released, the pressure in port 4 drops and the diaphragm, bent upward by the pressure of the air in the brake chambers, connects space *d* to port 6 which leads to the atmosphere. In this case, the diaphragm rests on ring *e*. Thus, the acceleration valve is also the valve for rapidly releasing the brakes.

4048	VALVE MECHANISM WITH AN ELASTIC MEMBRANE	EHP Va



Air is admitted through ports *a* and *d* into the central space in the valve where it applies pressure to membrane *1*. Attached to the membrane are pistons *2* and *3* which are subject to the pressure of a fluid. Membrane *1* is in its central position when the pressure of the air is equal on its right and left sides. When the pressure at the left increases, membrane *1* with pistons *2* and *3* moves to the right. At this, plunger *2'* opens passage *b* and admits fluid under pressure into the servomotor. Membrane *1* returns to its neutral position due to the difference in the effective areas of the cross sections of plungers *2'* and *3'*. When the pressure at the right increases, membrane *1* with pistons *2* and *3* moves to the left. Plunger *3'* opens passage *f* and the pressure in the servomotor drops. Membrane *1* is returned to its neutral position by the pressure of fluid delivered by the pump.

4049	REDUCING VALVE MECHANISM WITH AN ELASTIC DIAPHRAGM	EHP Va

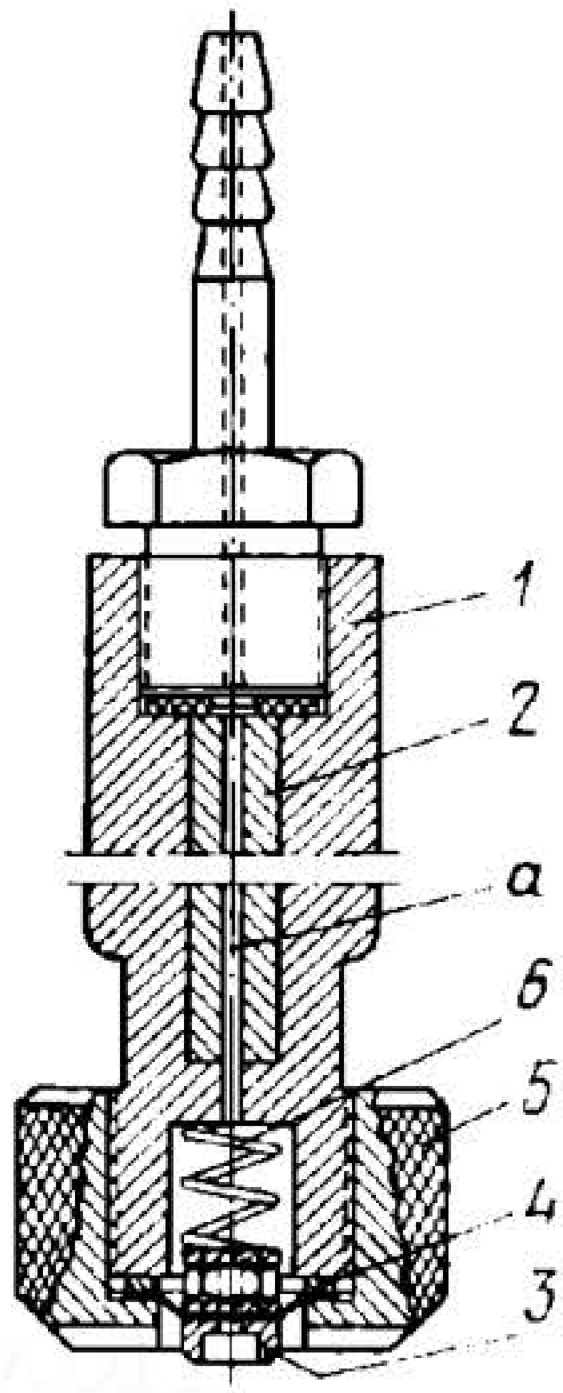


Fluid delivered by pump *1* passes through flow regulator *2* to reducing valves *3*. Valve member *4* of reducing valve *3* is subject to the pressure of the entering fluid below, and to the pressure of the fluid in chamber *a* above. Also acting from above through pusher *b* is the force exerted by elastic diaphragm *5*, which is subject to the constant pressure of spring *6* and the variable pressure of the fluid in chamber *f*. Chamber *f* is connected by holes to chamber *a*. Upon an increase in pressure in chamber *a*, the total force acting on valve member *4* from below becomes more than that acting above because the area of the diaphragm is greater than that of member *4*. Diaphragm *5* is bent upward, valve member *4* is raised by the pressure of the fluid, reducing the clear opening. This throttling effect reduces the pressure in chamber *a*.

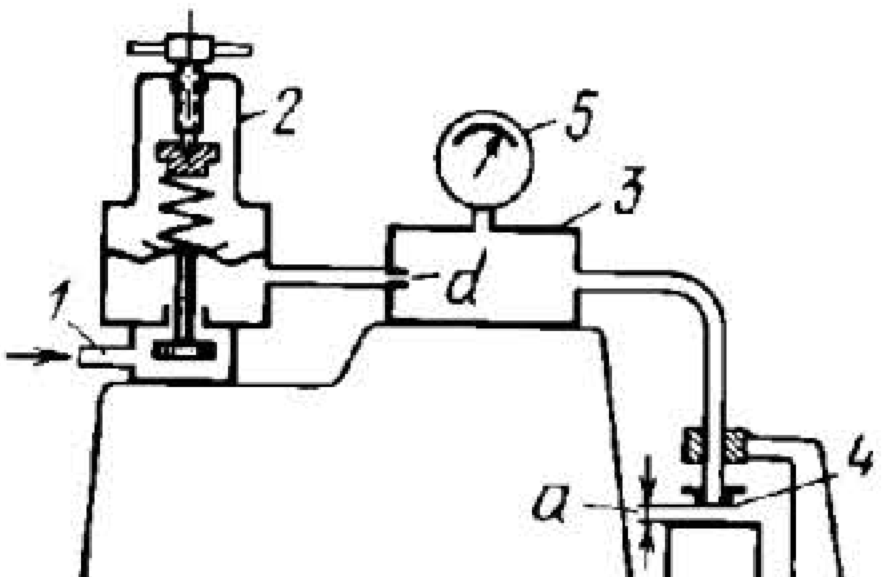
2. MECHANISMS OF MEASURING AND TESTING DEVICES (4050 through 4083)

4050	SELF-ALIGNING PNEUMATIC MEASURING HEAD MECHANISM	EHP M

Compressed air is delivered through the measuring chamber into the self-aligning measuring head. Sleeve *2* with passage *a* for air flow is pressfitted into body *1* of the head. Cylindrical nozzle *3* is secured on rubber membrane *4* which is held by nut *5* to body *1*. The pressure of the air from the measuring head bends the membrane, setting the nozzle properly with respect to the surface whose roughness is to be measured. Spring *6* holds nozzle *3* against the surface, properly aligned regardless of the position of supporting nut *5*. The pressure in the measuring head, determined by a water-column manometer, indicates the height of the surface irregularities of the work.

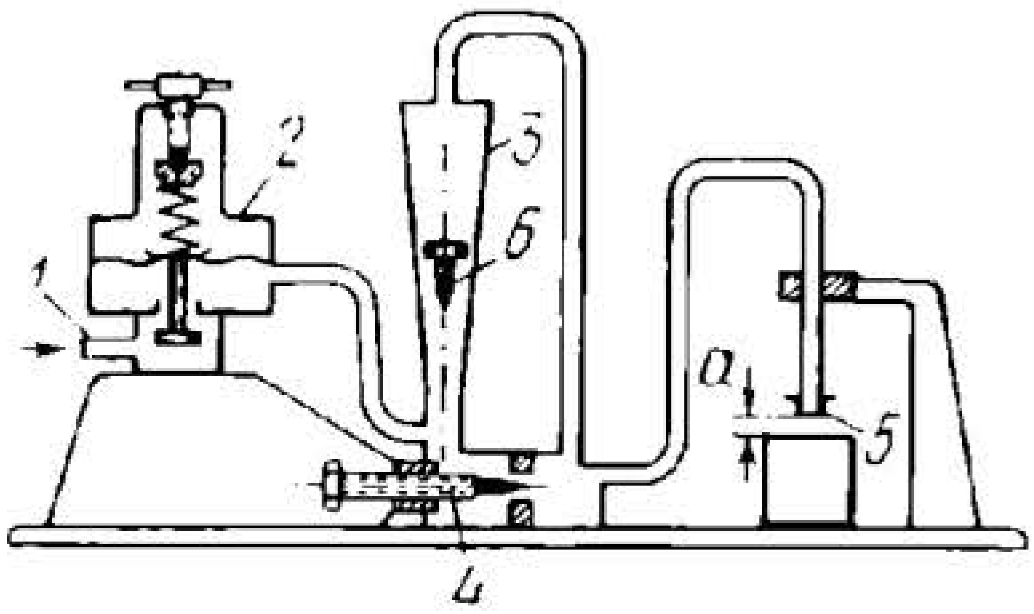


4051	PNEUMATIC GAUGING INSTRUMENT MECHANISM	EHP M



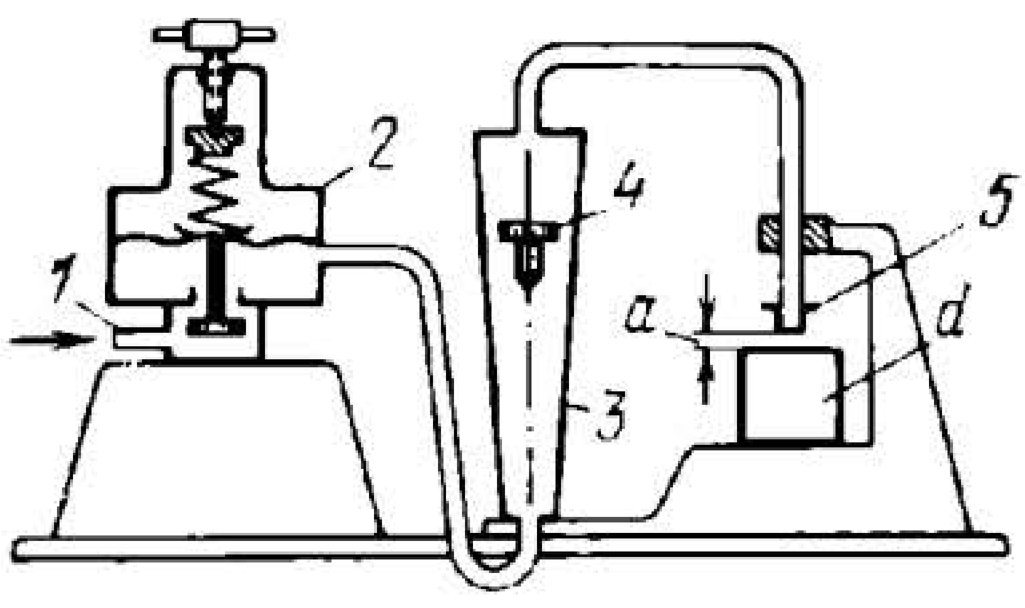
Compressed air is delivered through tube *1* into membrane-type pressure stabilizer *2* and further, through restrictor *d* to measuring chamber *3* and measuring head *4*. Depending upon clearance *a* between the end face of the nozzle and the surface of the work being checked, a definite pressure is established in measuring head *3*. This pressure is measured by pressure gauge *5*. The pressure-gauge scale can be graduated in units that show the deviation in work size from the basic value.

4052	PNEUMATIC GAUGING INSTRUMENT MECHANISM WITH A FLOW GAUGE IN PARALLEL	EHP M



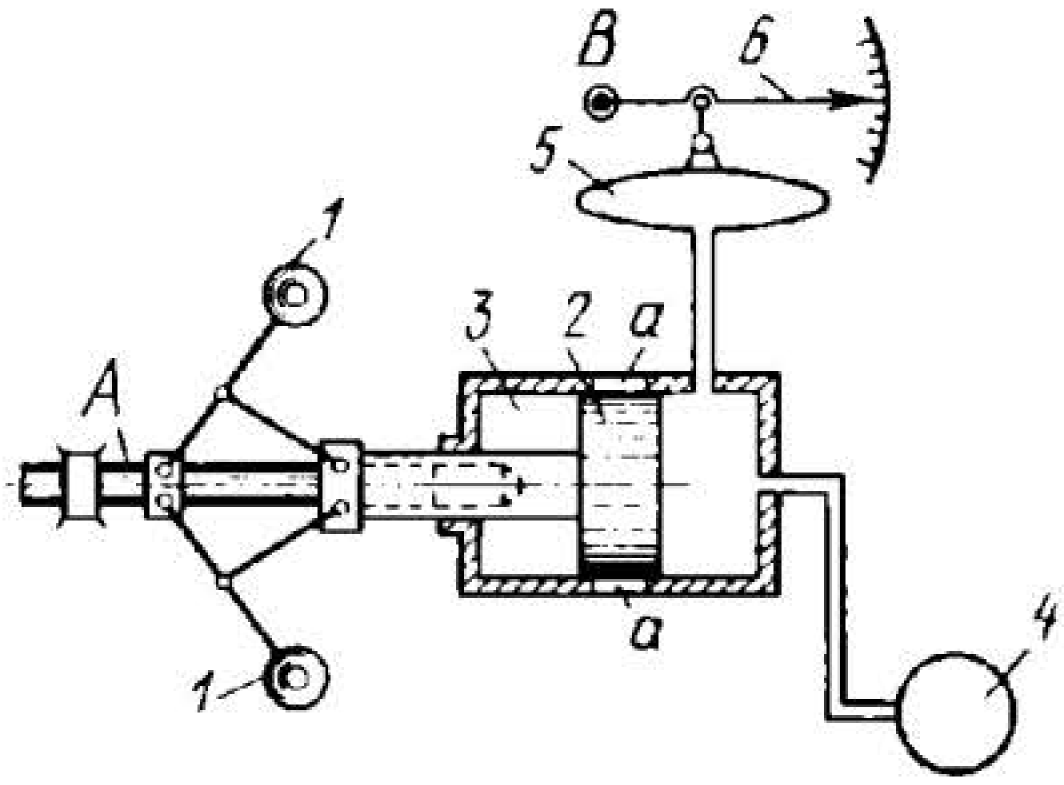
Compressed air is delivered through tube *1* into membrane-type pressure stabilizer *2* after which the air stream is divided into two parts: one passing through internally tapered glass indicator column *3* and the other through conical valve *4* to measuring head *5* to which air passes from column *3* as well. Depending upon clearance *a* between the end face of measuring head *5* and the surface of the work being checked, the flow of air and, consequently, its velocity are varied. Lightweight float *6* rises in column *3* until equilibrium is reached between the action of gravity and the air flow on the float. The flow-gauge scale is graduated in units showing the deviation in work size from the basic value.

4053	PNEUMATIC GAUGING INSTRUMENT MECHANISM WITH A FLOW GAUGE IN SERIES	EHP M



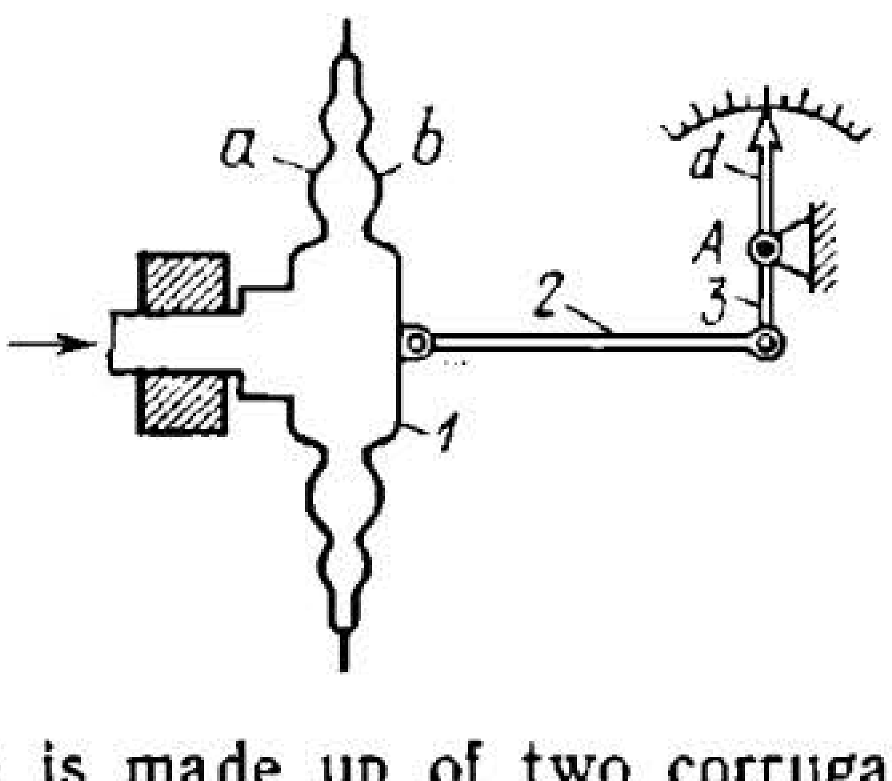
Compressed air is delivered through tube *1* into membrane-type pressure stabilizer *2* and further, through internally tapered glass indicator column *3*, containing lightweight float *4*, to measuring head *5*. The float is held in the suspended state by the flow of air. Depending upon clearance *a* between the end face of measuring head *5* and the surface of work *d* being checked, the flow of air and, consequently, its velocity are varied. Float *4* rises and lowers in column *3* until equilibrium is reached between the action of gravity and the air flow on the float. The scale, on which a reading is taken at the upper edge of the float, can be graduated in units showing the deviation of the work size from the basic value.

4054	PNEUMATIC CENTRIFUGAL TACHOMETER MECHANISM	EHP M



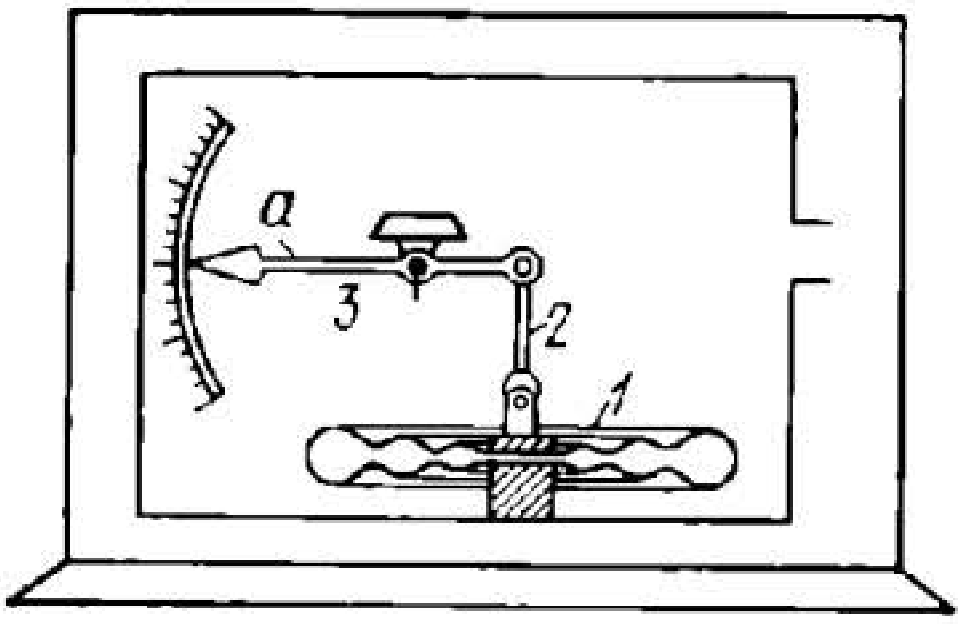
Shaft A of the tachometer is driven by the shaft whose speed is to be measured. The centrifugal force of weights 1 move piston 2 to the left in cylinder 3 which is filled with compressed air. The air is delivered into the cylinder by pump 4. The higher the angular velocity of the shaft being tested, the more piston 2 uncovers ports a of cylinder 3 and the less, consequently, the pressure in the cylinder and pressure gauge tube 5. Thus, any variation in the angular velocity of the shaft being tested is indicated on a scale by hand 6, which turns about fixed axis B.

4055	MEMBRANE PRESSURE GAUGE BOX MECHANISM	EHP M



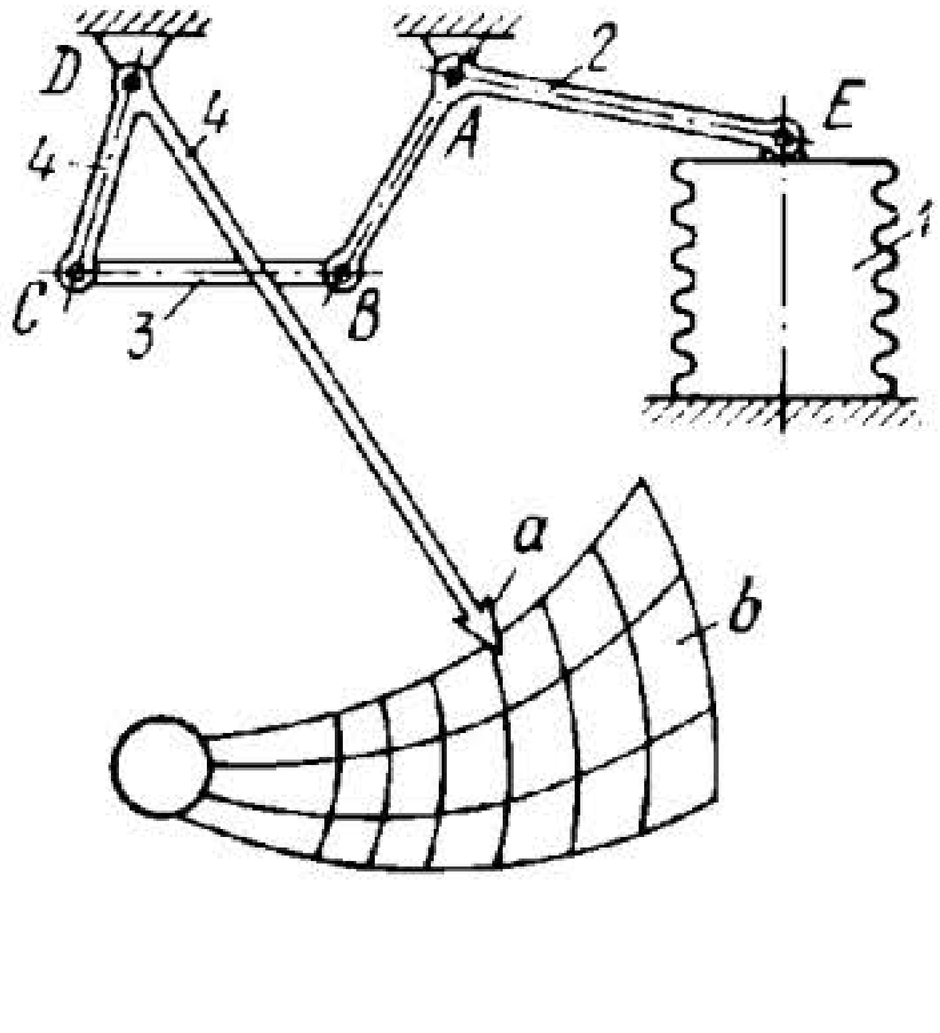
Membrane box 1 is made up of two corrugated membranes a and b, soldered together. The centre of membrane a is stationary and is secured to a pipe member which is to be connected to the space where the pressure is to be measured. The centre of membrane b is linked to the mechanism for operating the gauge hand. When there is a difference in pressure inside and outside the box, movable membrane b bends inward or outward. Motion of the membrane is transmitted by tie-rod 2 to lever 3 of hand d, turning about fixed axis A. Such a membrane box is used to measure the relative pressure.

4056	ANEROID CAPSULE MECHANISM	EHP M



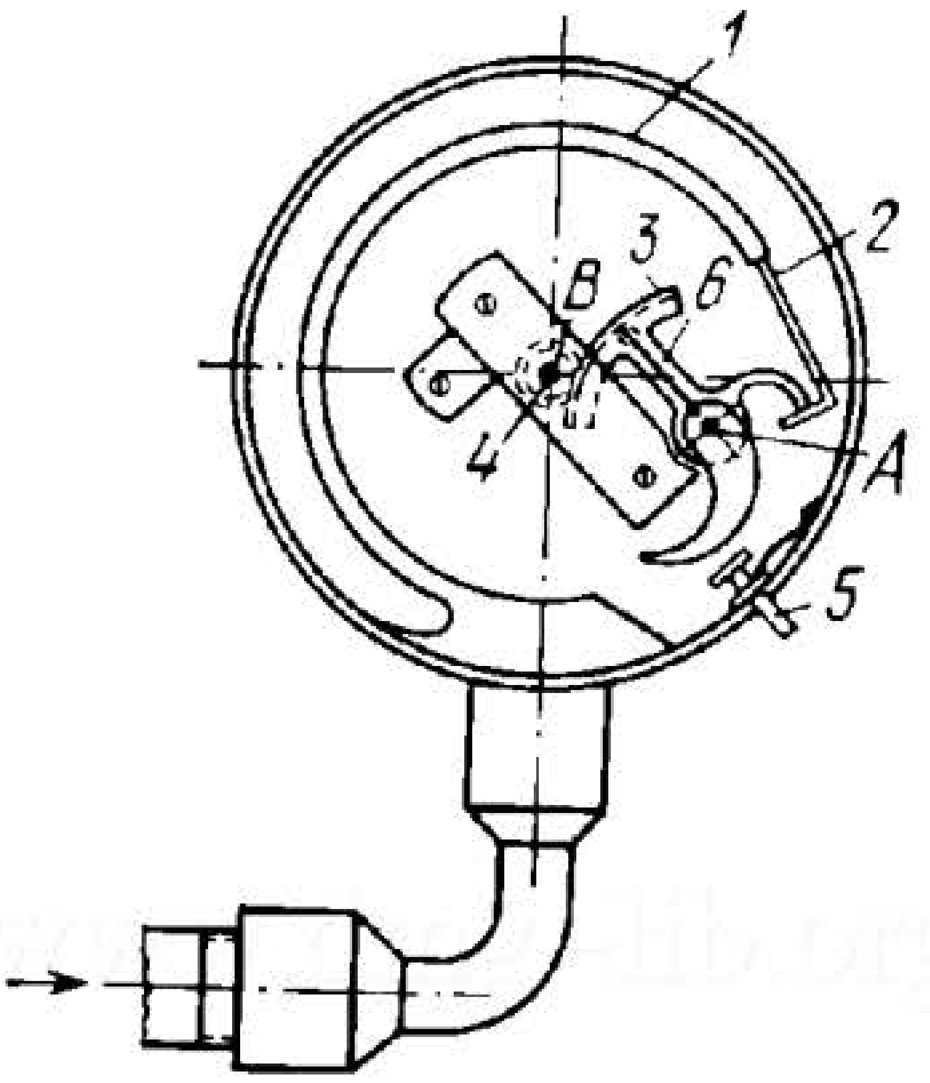
An aneroid capsule is an airtight soldered membrane box out of which the air has been evacuated. It is used to measure the absolute pressure of the air surrounding the capsule. Upon a change in pressure, the capsule is deformed and its motion is transmitted by tie-rod *2* and lever *3* to hand *a*, turning about a fixed axis.

4057	LINKWORK MECHANISM OF A BELLOWS-OPERATED PRESSURE GAUGE	EHP M



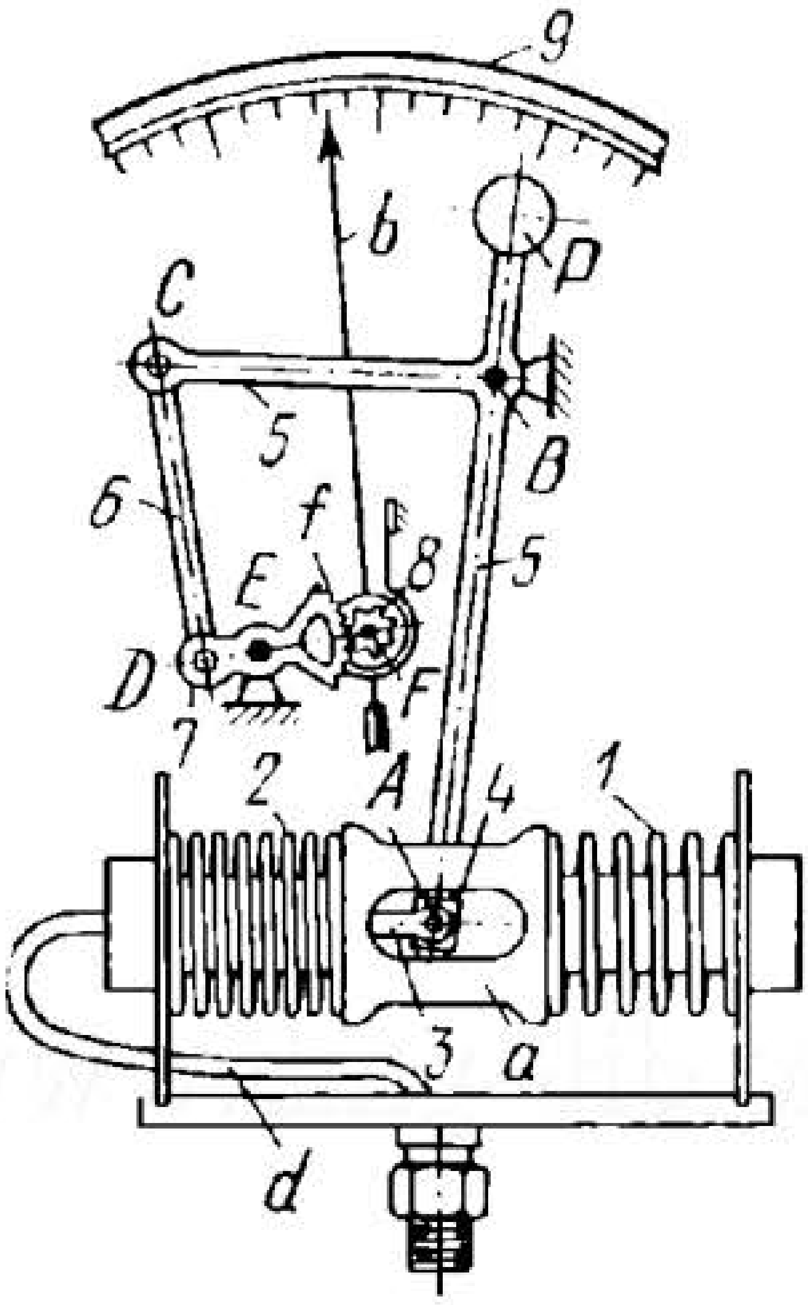
Bellows *1* is connected by turning pair *E* to bell-crank lever *2* which turns about fixed axis *A*. Connecting rod *3* is connected by turning pairs *B* and *C* to lever *2* and to link *4* which turns about fixed axis *D*. Rigidly attached to link *4* is hand *a* of the instrument. When the pressure changes inside bellows *1* it is either contracted or stretched axially. This motion is indicated by hand *a* on scale *b*.

TIRE GAUGE MECHANISM



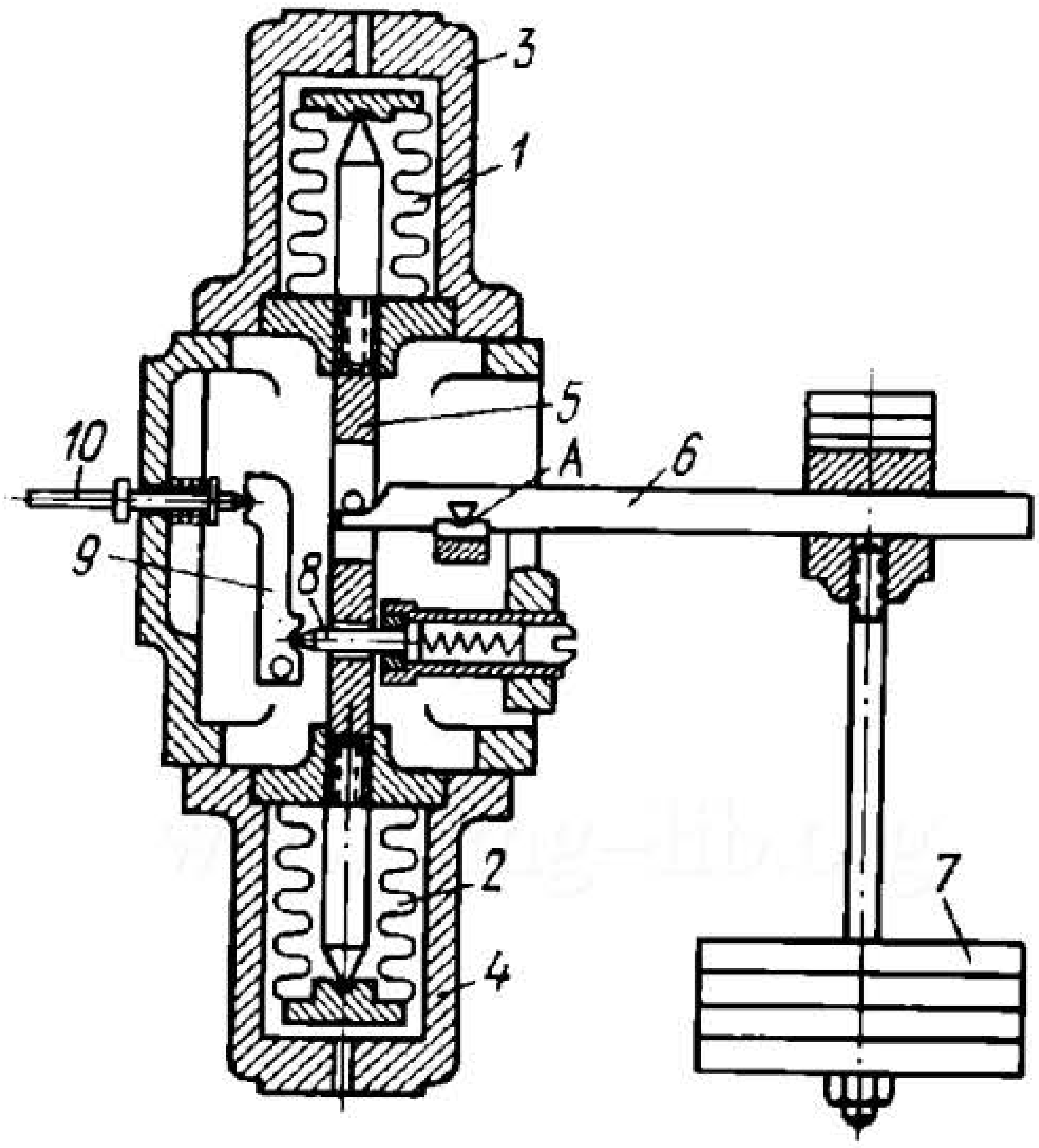
When the pressure increases in Bourdon tube *1*, one end of which is fixed, the tube tends to straighten out, and member *2*, attached to the movable end of the tube, turns segment gear *3* about fixed axis *A*. Segment gear *3* meshes with pinion *4*, turning about fixed axis *B*, to which a hand is attached. Member *2* is not linked to segment gear *3*. Thus, when the pressure drops and tube *1* returns to its initial position, segment gear *3* and the hand remain in the position they were in as a result of deformation of tube *1*. The hand is returned to the zero position by retracting device *5*. When the retracting button is pushed, it turns segment gear *3* by means of flat spring *6* and zeroes the hand.

4059	LEVER MECHANISM OF A PRESSURE-VACUUM GAUGE	EHP M



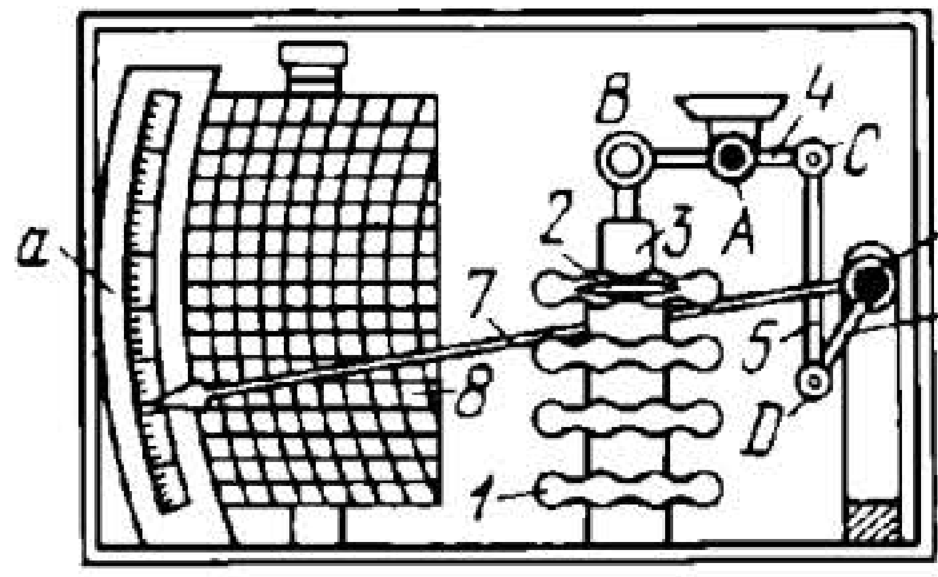
Bellows 1 and 2 are rigidly attached together by eans of hollow cylinder *a*. The air is evacuated from bellows 1, and bellows 2 is connected by tube *d* to the space in which the pressure is to be measured. As bellows 2 is deformed by the pressure, link 3, attached to bellows 2, is displaced. Link 3 is connected by turning pair *A* to slider 4 which slides along the axis of link 5, turning about fixed axis *B*. Connecting rod 6 is connected by turning pairs *C* and *D* to links 5 and 7. Link 7 turns about fixed axis *E* and has segment gear *f* which meshes with pinion 8, turning about fixed axis *F*. The readings of the gauge are indicated by hand *b*, rigidly attached to pinion 8, on scale 9. Weight *P* counterbalances the weight of link 5.

4060	LEVER MECHANISM OF A GAUGE FOR MEASURING PRESSURE DIFFERENCE	EHP M



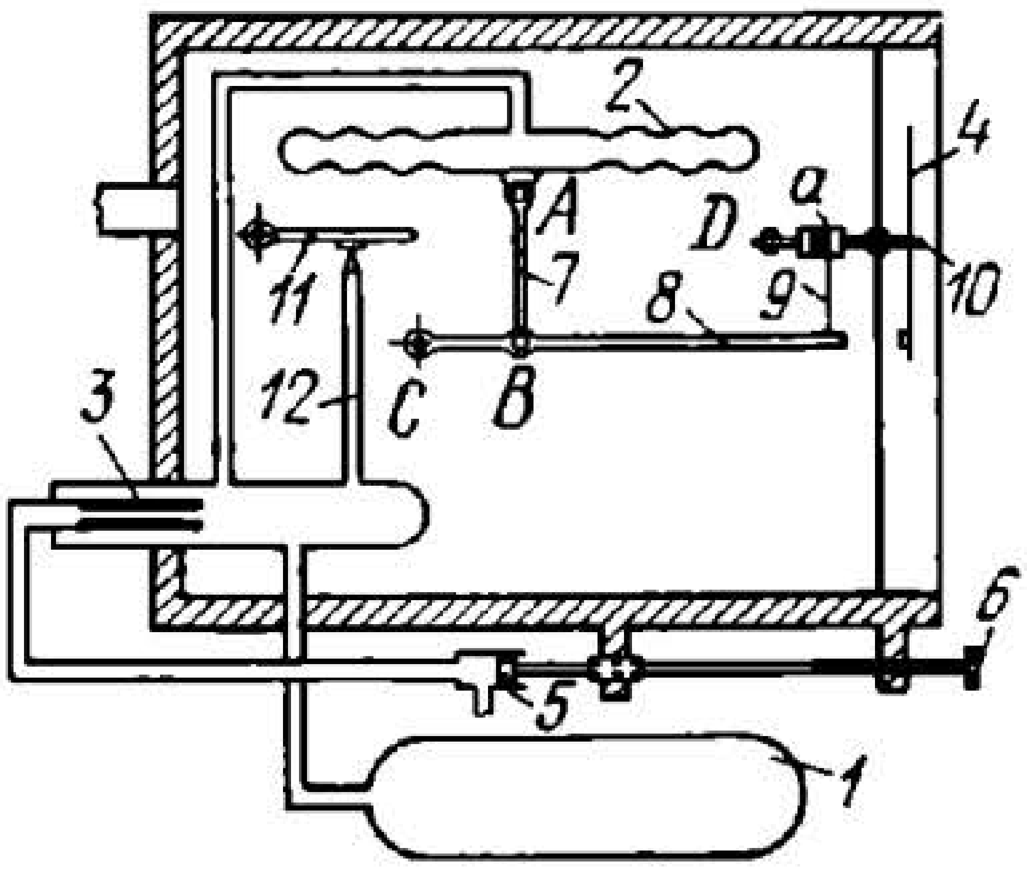
The chambers of cylinders *3* and *4*, containing bellows *1* and *2*, are connected to the spaces whose difference in pressure is to be measured. Cylinders *3* and *4* are joined by stem *5*. Stem *5* is subject to the action of weight *7*, transmitted through lever *6* which turns about fixed point *A*. Weight *7* develops the counterbalancing moment. The movement of stem *5* depends upon the difference in pressures in cylinders *3* and *4*. This difference is determined by setting weight *7* along lever *6* to the equilibrium position. Pushers *8* and *10*, and lever *9* enable the equilibrium position of lever *6* to be accurately determined.

4061	LEVER MECHANISM OF A BAROGRAPH	EHP M



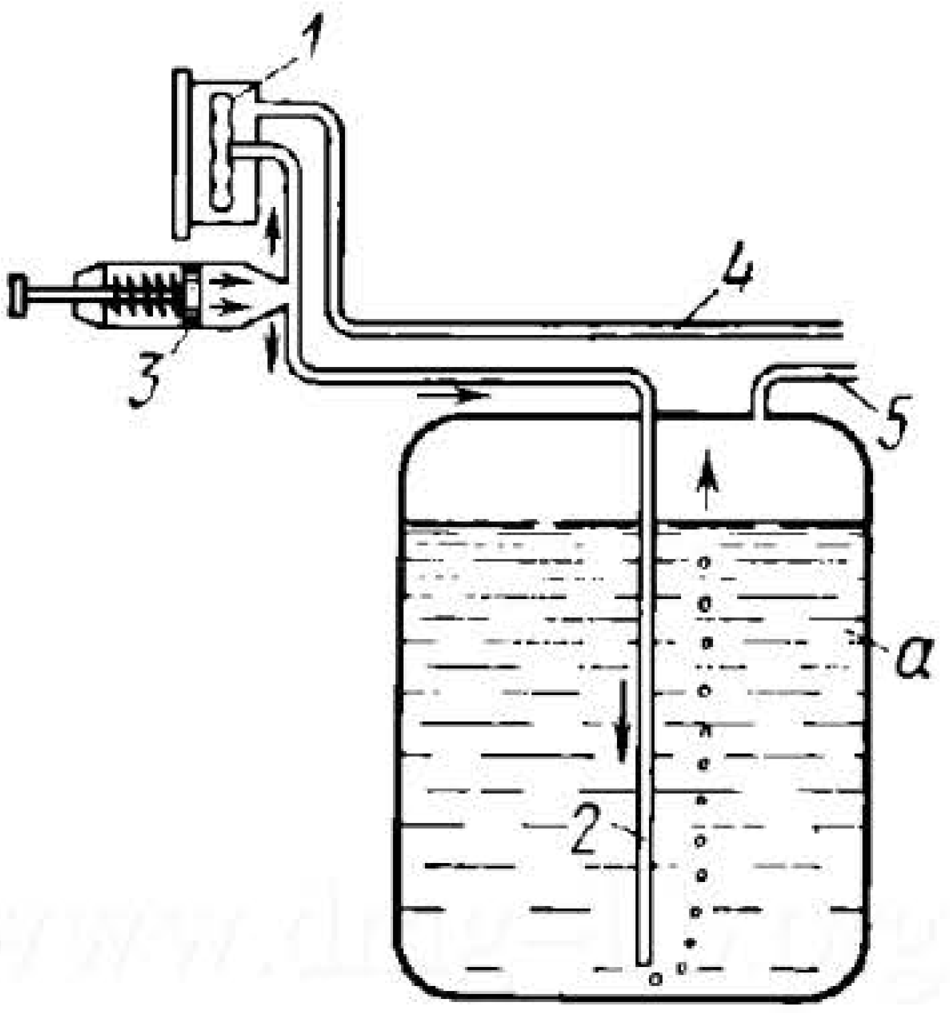
Each of the four membrane boxes *1*, connected to one another in series, contains spring *2* whose purpose is to ensure proportionality of the barograph scale. Upon a change in atmospheric pressure the whole system of boxes is deformed and this motion is transmitted by pin *3* to link *4*, which is connected to link *3* by turning pair *B* and turns about fixed axis *A*. Connecting rod *5* is connected by turning pairs *C* and *D* to link *4* and to link *6* which turns about fixed axis *E*. Rigidly attached to link *6* is hand *7* which indicates the readings of the barograph on scale *a* and carries a pen that registers the readings on a paper chart wound on rotating drum *8*.

4062	LEVER MECHANISM OF A RATE-OF-CLIMB INDICATOR	EHP M



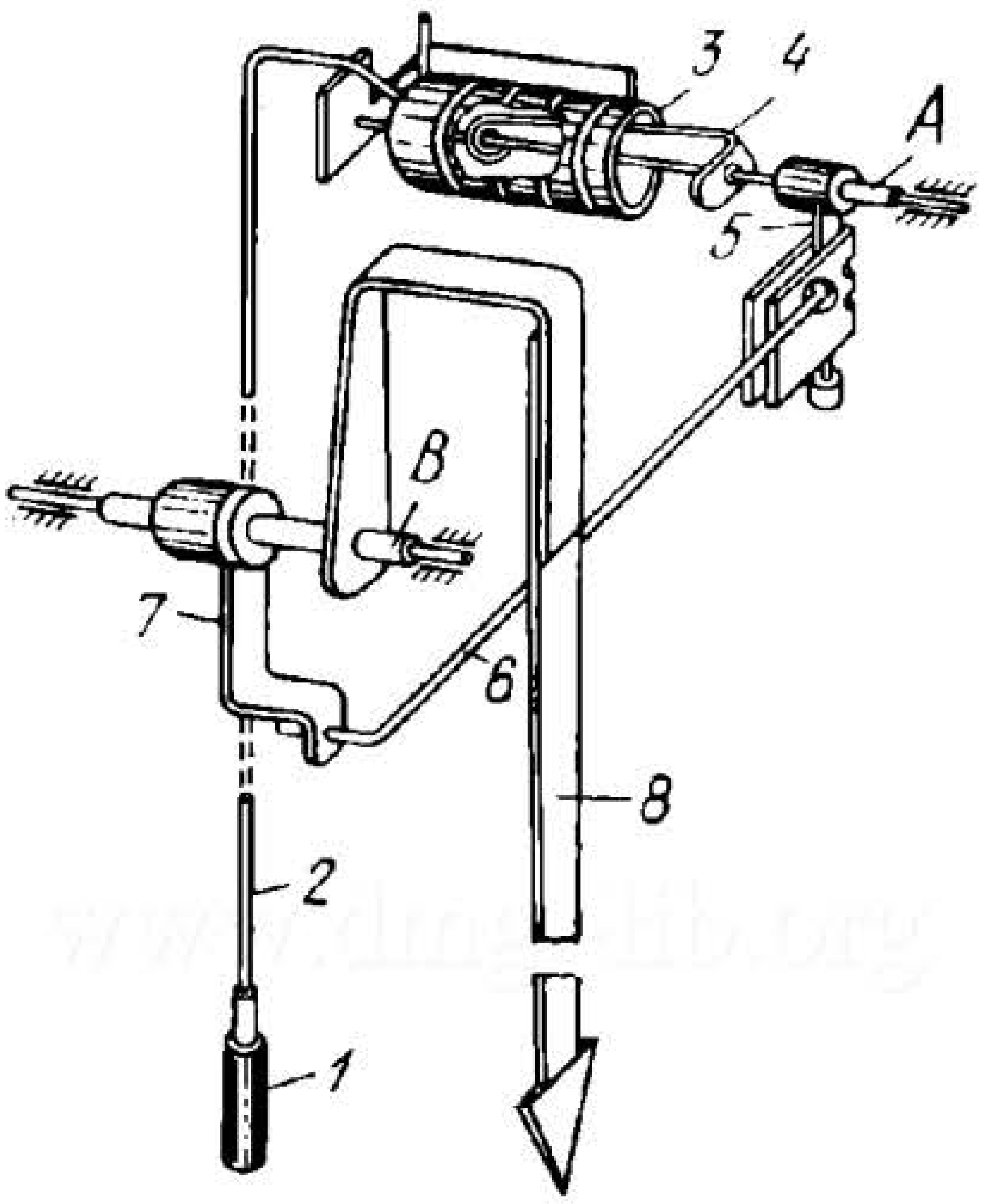
Vessel *1* is connected to membrane box *2* and also to the atmosphere through capillary tube *3*. Depending upon the vertical velocity of the item on which the instrument is mounted, the pressure inside and outside membrane box *2* differs due to the retarded flow of air through the narrow passage in capillary tube *3*. This deforms membrane box *2* and its motion is transmitted to shaft *10* to which hand *4* is attached. The hand is turned by means of link *7*, connected by turning pairs *A* and *B* to membrane box *2* and to lever *8*, turning about fixed axis *C*, and flexible link *9* which is wound around drum *a*. Drum *a* is rigidly mounted on shaft *10* which turns about fixed axis *D*. Capillary tube *3* is enclosed in a metal housing connected to the atmosphere through valve *5* which can be closed with handle *6*. The instrument is protected against overloads by valve *11* which opens automatically and admits air (in climbing) or releases air (in descending) into or from membrane box *2* through the orifice in nozzle *12*. This limits the load on the membrane box.

4063	**HYDROSTATIC GASOLINE GAUGE MECHANISM FOR AIRCRAFT**	EHP M



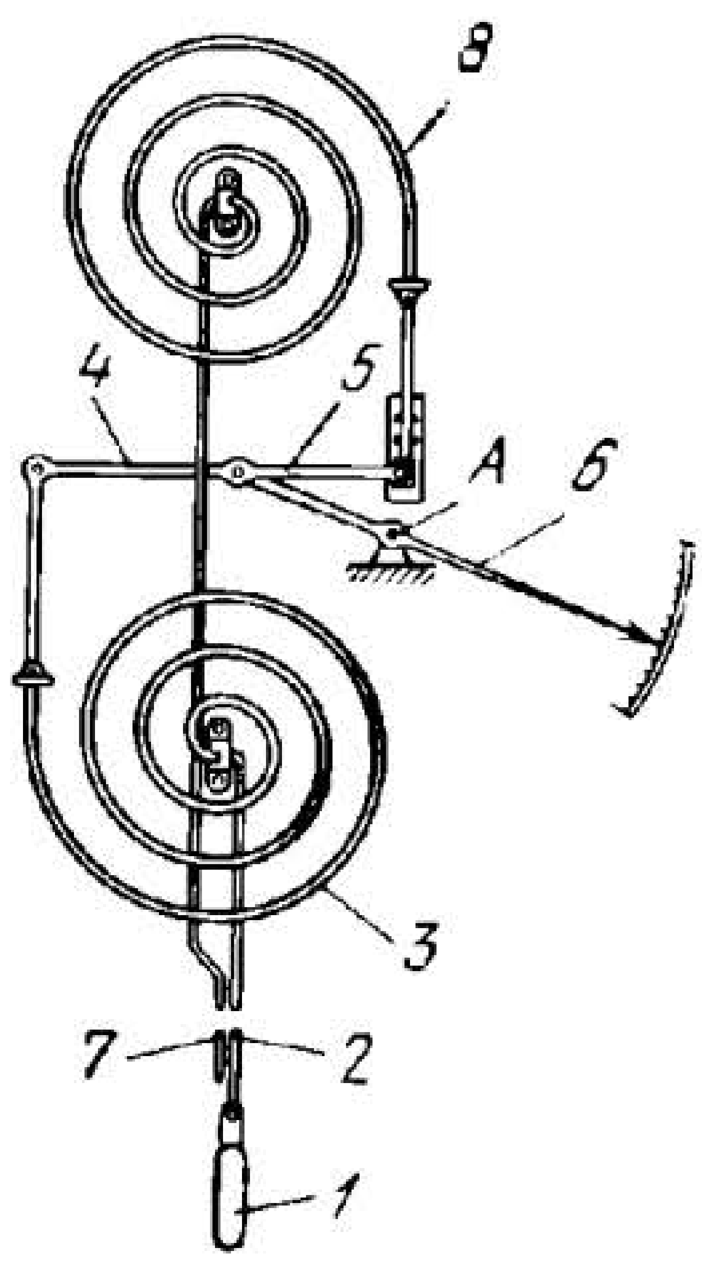
The pressure of the fuel is measured by pressure gauge member *1* whose inside chamber is connected to tube *2*, immersed in the gasoline tank. Pump *3* is connected to tube *2*. The pressure in the housing of gauge member *1* is equal to the pressure of the air above the level of the fuel in the tank because tube *4* is connected to air tube *5* of the tank. A certain air pressure is established in the pump cylinder which is transmitted simultaneously to tank *a* and to pressure gauge member *1*. The air delivered by the pump forces the gasoline out of tube *2*. This establishes a pressure in the gasoline gauge system that is proportional to the level of the gasoline. The hand (not shown) of member *1* indicates this pressure on a scale.

4064	GAS THERMOMETER MECHANISM	EHP M



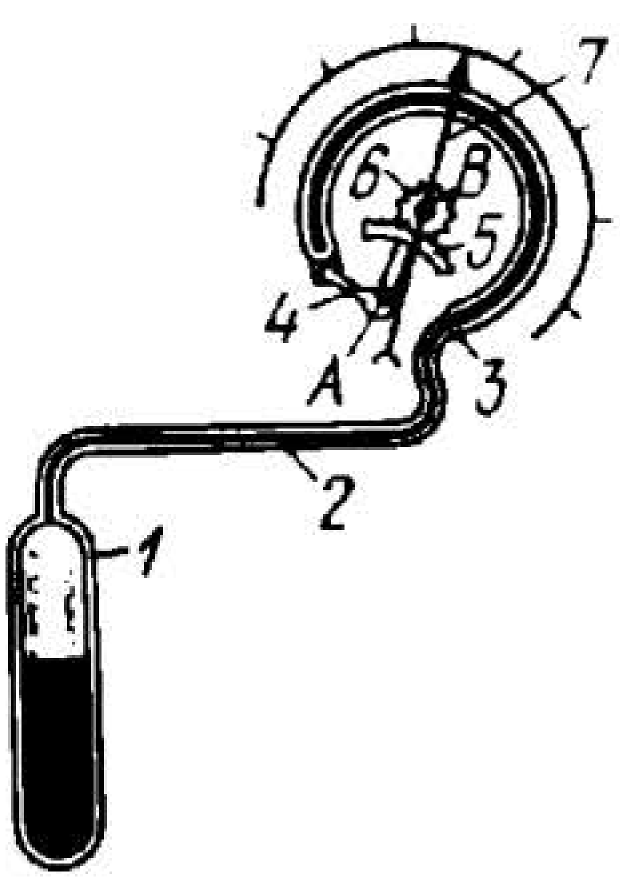
Upon a change in the temperature of thermal bulb *1*, filled with gas and immersed in the medium whose temperature is to be measured, the pressure changes in capillary tube *2* and in helical tubular spring *3*, connected to tube *2*. One end of the tubular spring is fixed and the other end, which moves when the spring is wound up or unwound by the change of pressure inside it, turns shaft *A*. Spring *3* is linked to shaft *A* through yoke *4*. Shaft *A* is linked through lever *5*, tie-rod *6* and lever *7* to shaft *B*. Rigidly mounted on shaft *B* is hand *8* or a pen which registers the temperature being measured.

4065	PRESSURE-SPRING THERMOMETER MECHANISM WITH TEMPERATURE COMPENSATION	EHP M



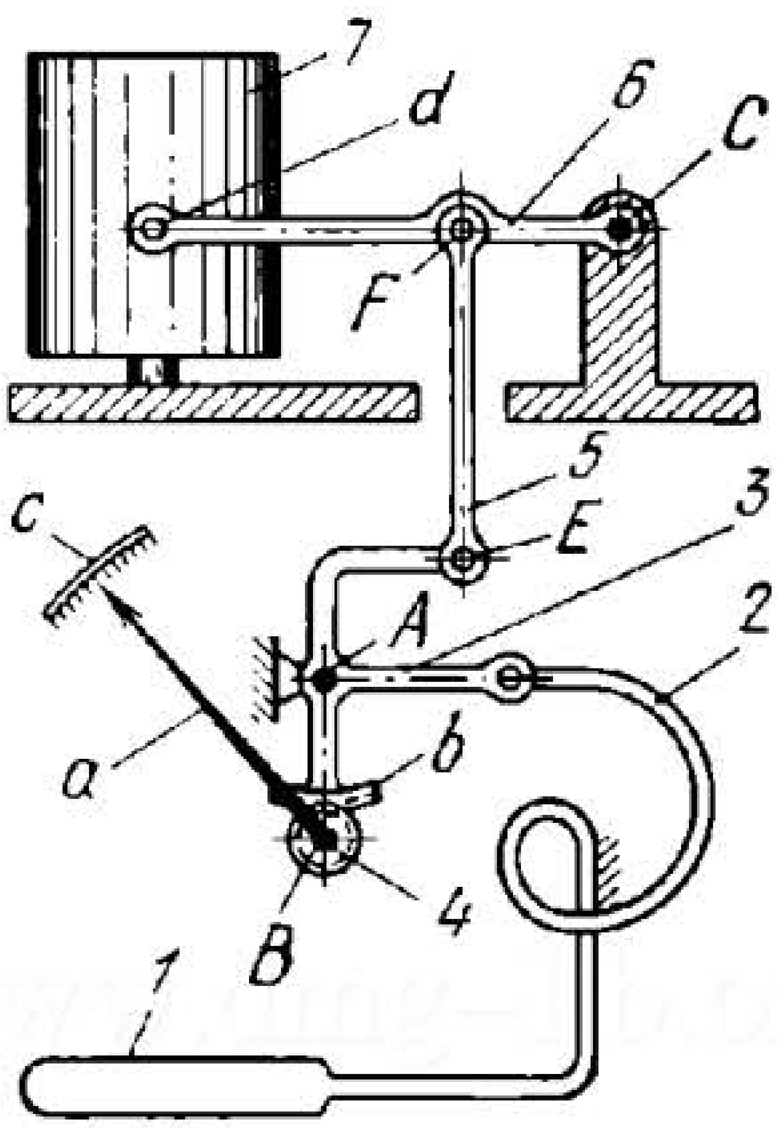
Upon a change in the temperature of thermal bulb *1*, filled with a liquid and immersed in the medium whose temperature is to be measured, the pressure changes in capillary tube *2*, which connects the bulb to tubular spring *3*, and in the spring itself. This spring, winding up or unwinding, turns hand *6* through tie-rod *4* about fixed axis *A*. To compensate for the effect of the ambient temperature on the reading, provision is made for a special device consisting of compensating capillary tube *7*, of the same length as the main tube, and auxiliary spiral tubular spring *8*, having the same properties as main spring *3*. Spring *8* actuates hand *6* through tie-rod *5* in the direction opposite to the action of spring *3*. This eliminates the influence of the ambient temperature on the reading of the instrument.

4066	LEVER-GEAR MECHANISM OF A HYDRAULIC AIR-TEMPERATURE INDICATOR	EHP M



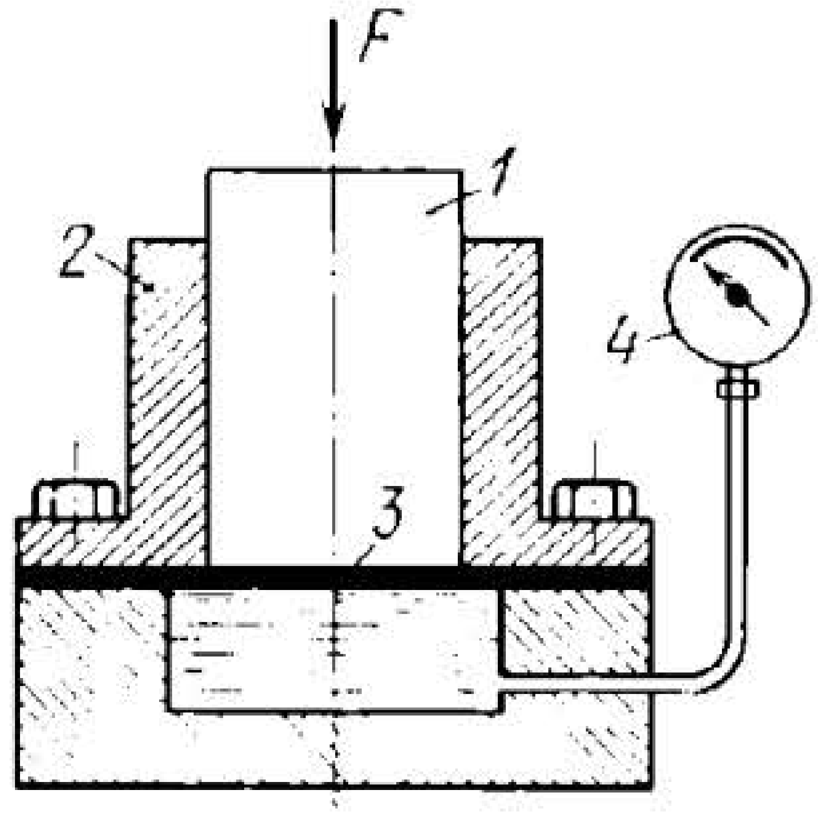
Container *1*, filled half full with a low-boiling liquid, is connected by tube *2* to Bourdon tube *3*. Tube *2* and the Bourdon tube are filled with a special liquid having a viscosity so high that it does not pour out of the tubes. A change in temperature of container *1* changes the pressure of the saturated vapour of the liquid in the container. This pressure is transmitted to the viscous liquid filling the Bourdon tube. Tube *3* is deformed and the motion of its free end is transmitted through link *4* and segment gear *5*, turning about fixed axis *A*, to pinion *6* and hand *7*, rigidly attached to the pinion and turning about fixed axis *B*.

4067	LEVER-GEAR MECHANISM OF A RECORDING THERMOMETER	EHP M



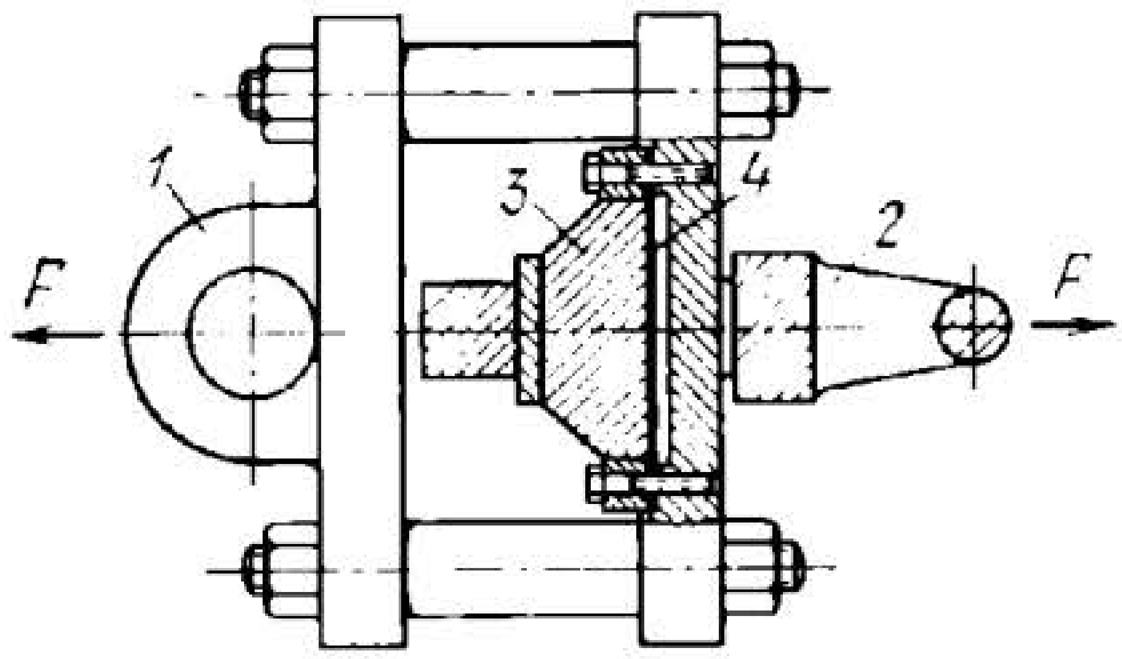
Upon a change in temperature of the medium in which thermal bulb 1 is immersed, the pressure of the liquid filling the thermal bulb and Bourdon tube 2 changes. Tube 2 is deformed and the motion of its free end turns three-arm lever 3 about fixed axis A. Segment gear b of the three-arm lever meshes with pinion 4, which is rigidly attached to hand a and turns about fixed axis B. Hand a indicates the reading of the instrument on scale c. At the same time, lever 3 operates pen d which records the temperature on a chart paper fastened to rotating drum 7. Motion is transmitted to pen d, rigidly mounted on lever 6 which turns about fixed axis C, through intermediate link 5. Link 5 is connected by turning pairs E and F to levers 3 and 6.

4068	**HYDRAULIC DYNAMOMETER MECHANISM WITH AN ELASTIC DIAPHRAGM**	EHP M



When the force being measured is applied to piston *1*, sliding in cylinder *2*, the force is transmitted through diaphragm *3* to the liquid. The liquid is compressed and its pressure is measured by pressure gauge *4*.

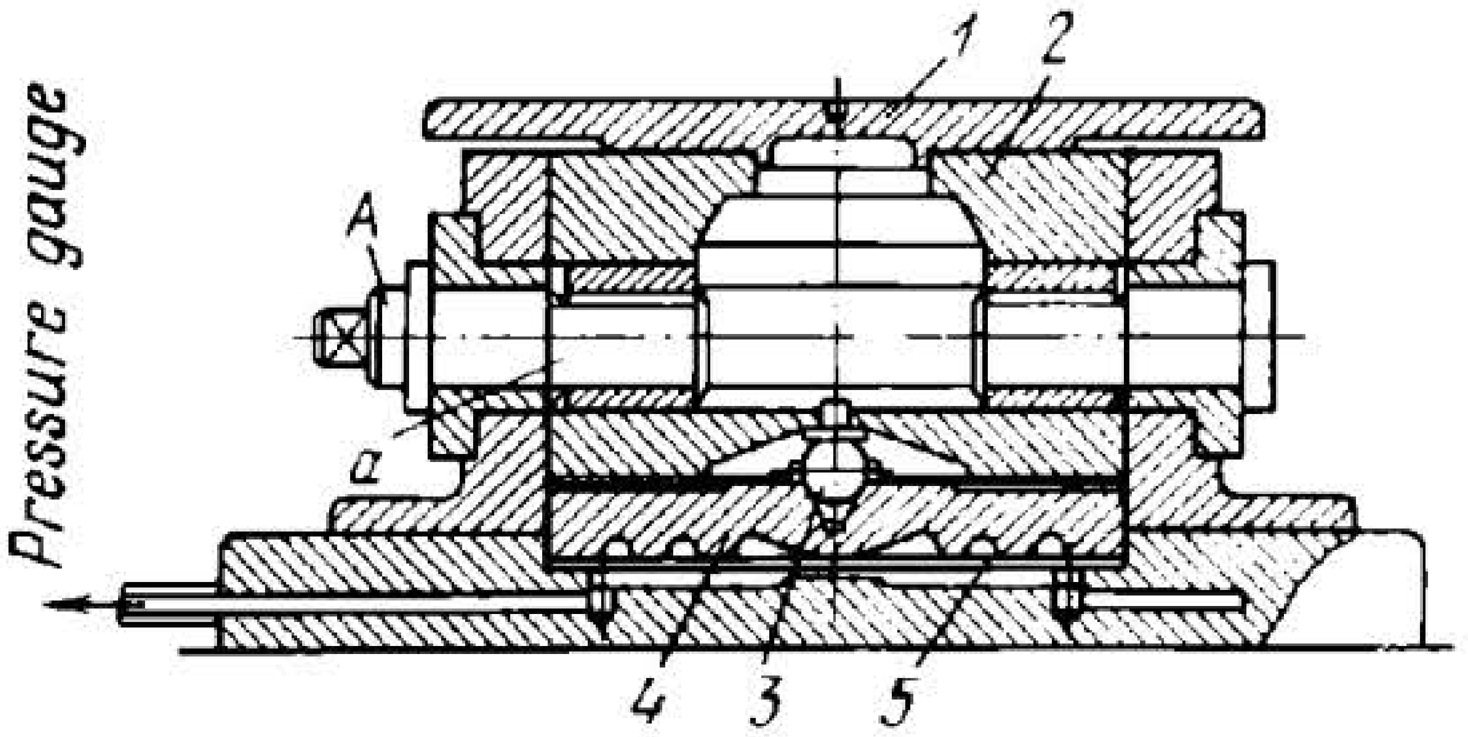
4069	**DYNAMOGRAPH MECHANISM WITH AN ELASTIC DIAPHRAGM**	EHP M



Tensile force F, applied to the dynamograph by means of reversing shackles *1* and *2*, designed as plates held together by bolts, is transmitted to piston *3*. Piston *3* acts through rubber diaphragm *4* on a liquid which fills the hydraulic capsule. The capsule is connected to a self-recording pressure gauge whose scale is graduated in units of the force being measured.

4070 HYDRAULIC SCALE MECHANISM WITH AN ELASTIC DIAPHRAGM

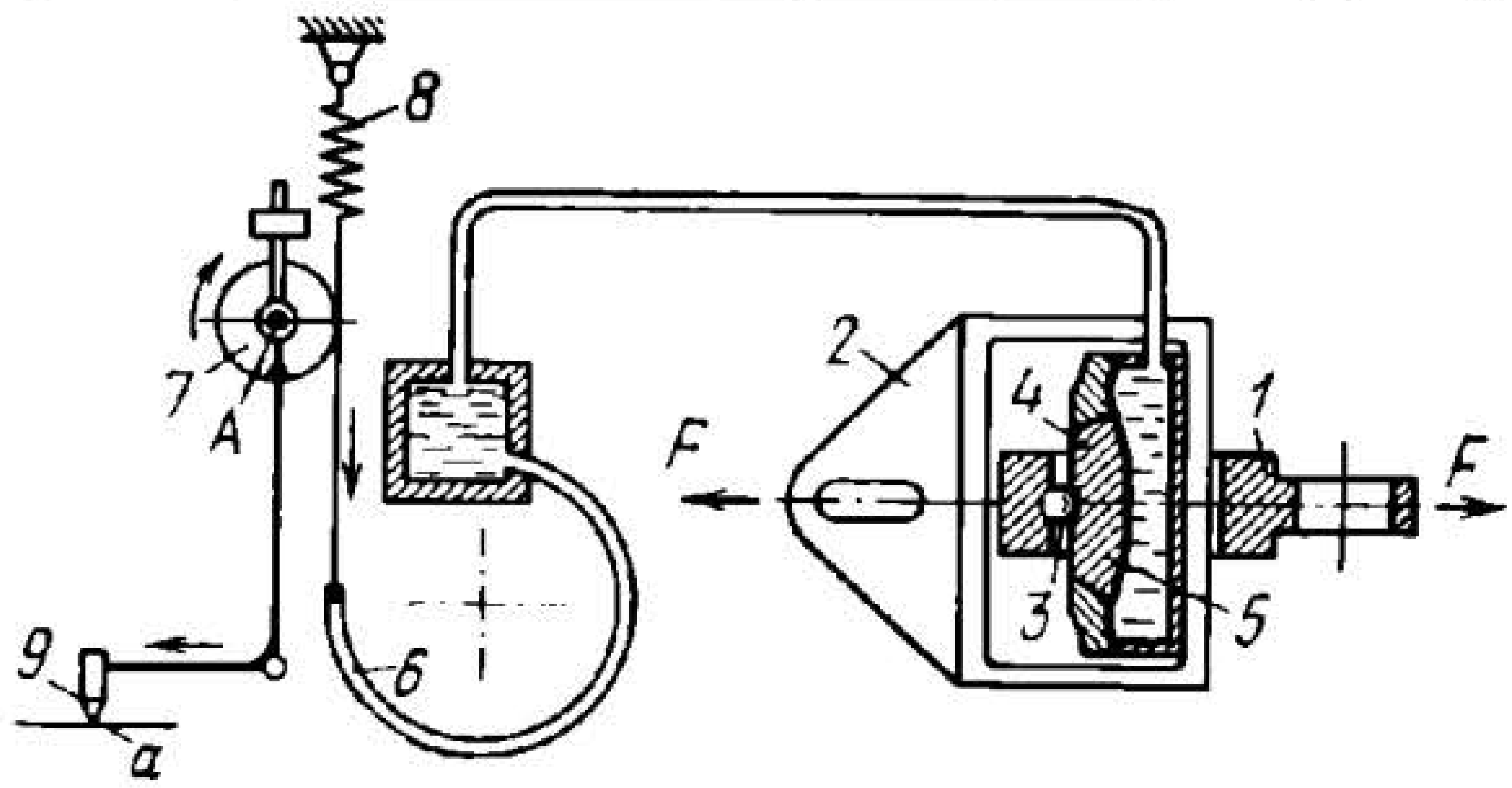
EHP
M



Platform *1*, on which the item being weighed is placed, rests on piston *2*. Piston *2* rests on steel ball *3* of the hydraulic capsule. The pressure of the ball is transmitted by member *4* to diaphragm *5* which compresses the liquid. The pressure of the liquid, proportional to the weight of the item, is measured by a pressure gauge. The scale is switched on and off by turning shaft *A*, having eccentric shoulders *a*.

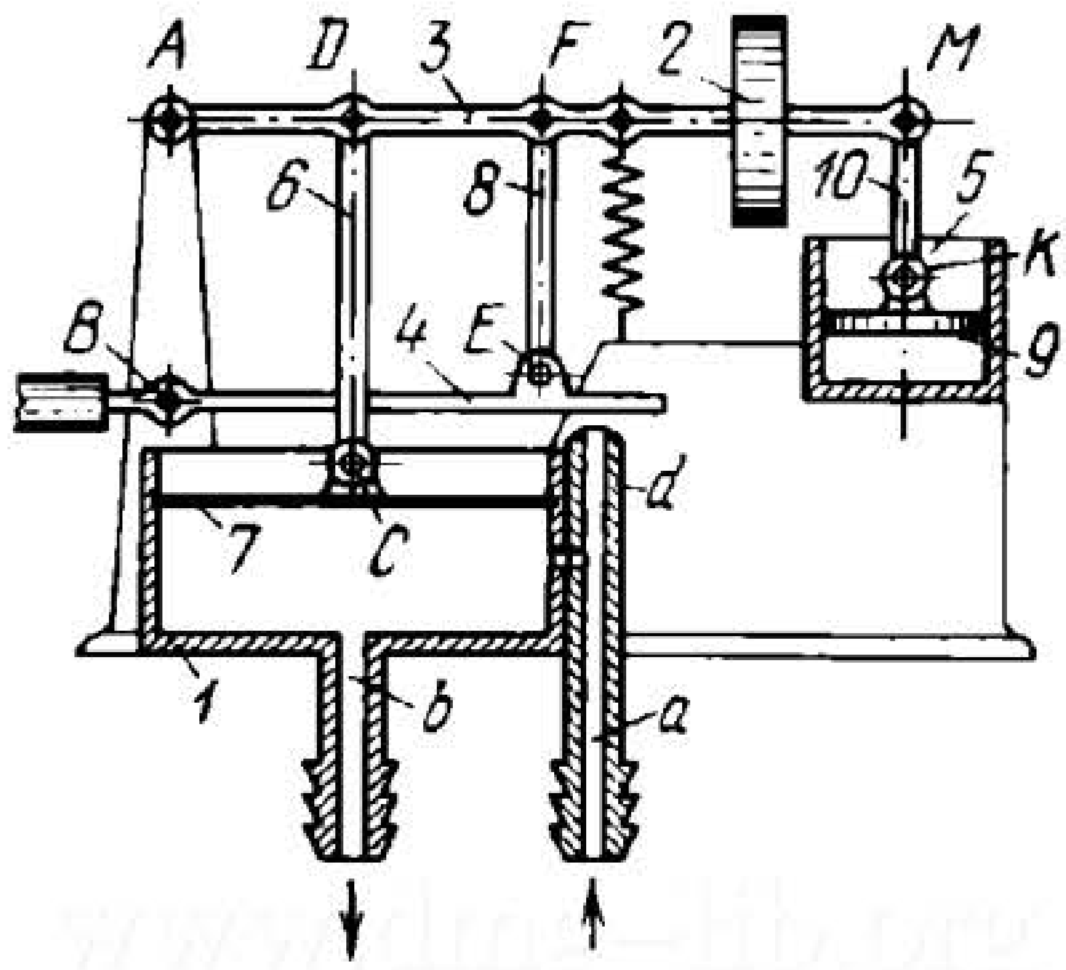
4071 HYDRAULIC TENSION DYNAMOGRAPH MECHANISM

EHP
M



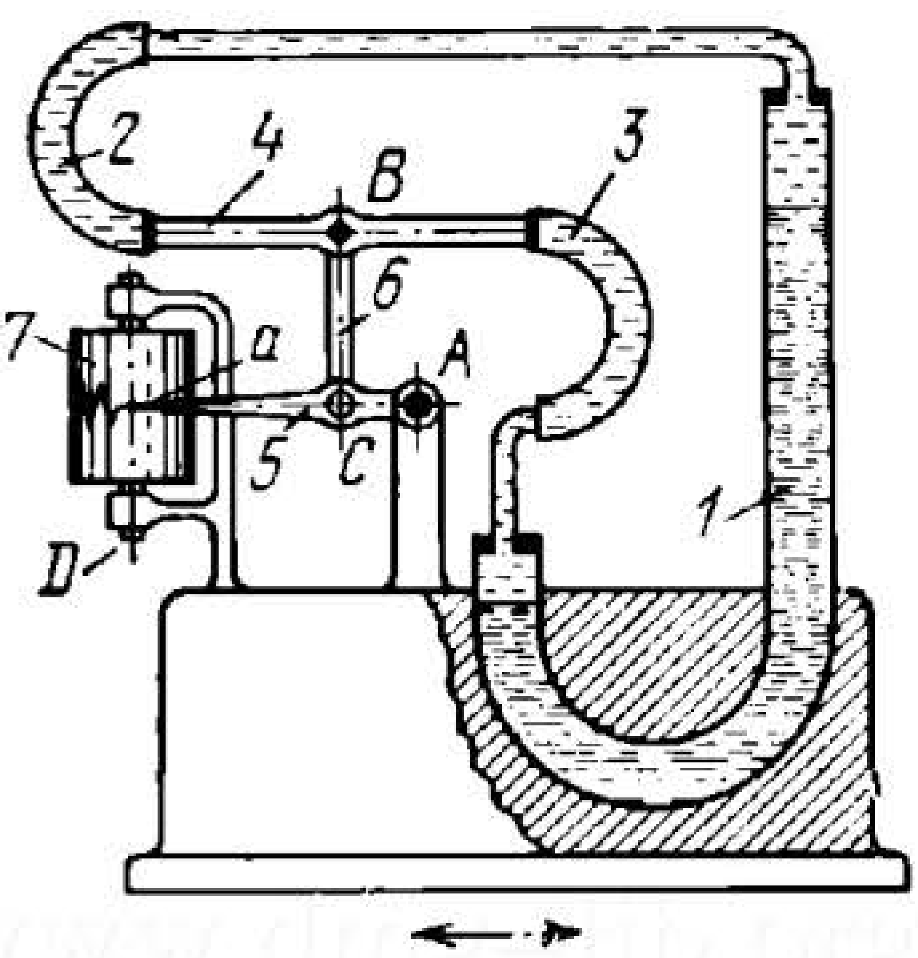
Tensile force *F* is applied by means of shackles *1* and *2* and steel ball *3* to piston *4* of the hydraulic capsule. Through diaphragm *5*, piston *4* applies pressure to the liquid. This pressure is transmitted to Bourdon tube *6* which tends to straighten out. The free end of tube *6* is connected through a flexible link, running over pulley *7*, to spring *8*. Pulley *7* turns about fixed axis *A* and is rigidly attached to pen *9* which registers the measured forces on chart paper *a*.

4072	**LINKWORK MECHANISM OF A PNEUMATIC ACCELEROMETER**	**EHP** **M**



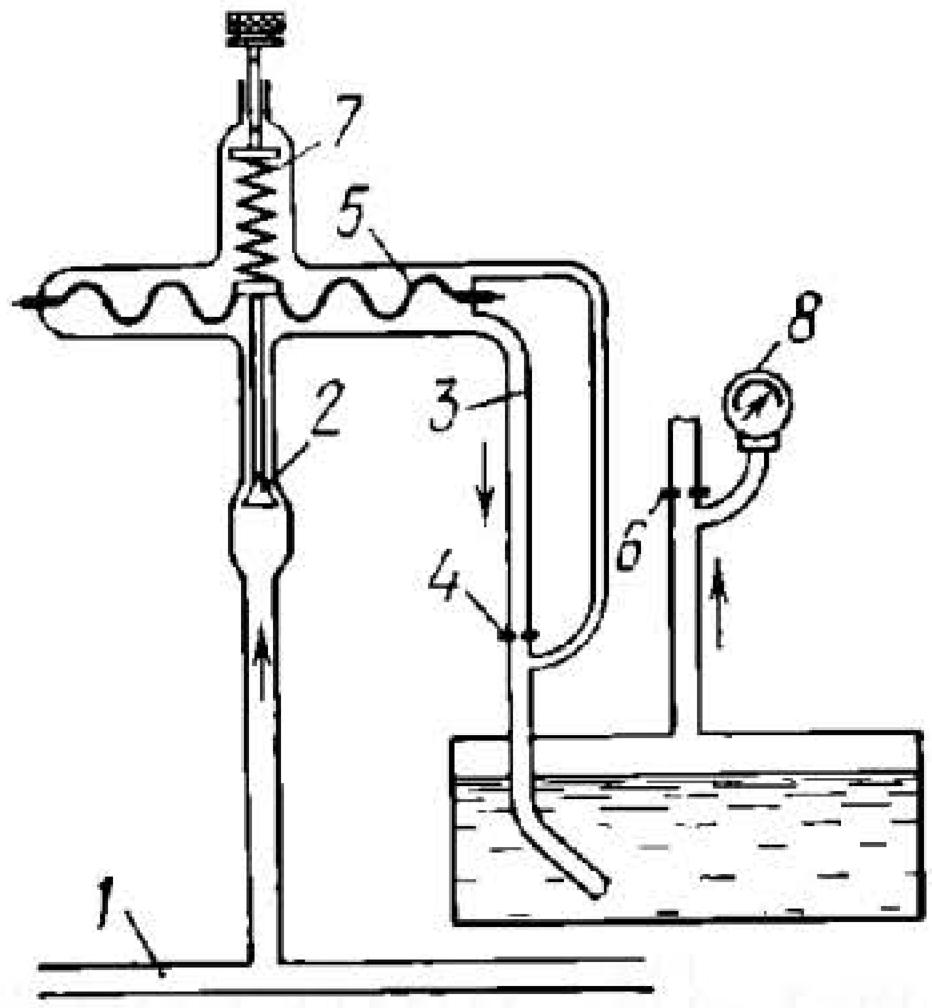
Compressed air is delivered to nipple *a* from where a part passes into membrane unit *1* and the remainder is discharged through nozzle *d*. In measuring vertical acceleration, sensing element *2* turns together with lever *3* about fixed axis *A*. This turns plate *4* about fixed axis *B*, bringing it nearer to or retracting it from nozzle *d*. The pressure in membrane unit *1*, connected by nipple *b* to a pressure gauge, depends upon the position of plate *4* with respect to nozzle *d*. Thus, the pressure in membrane unit *1* depends upon the vertical acceleration being measured. Motion is transmitted from membrane *7* to lever *3* through link *6*, connected by turning pairs *C* and *D* to membrane *7* and to lever *3*. Motion is transmitted from lever *3* to plate *4* through link *8*, connected by turning pairs *E* and *F* to plate *4* and to lever *3*. The pressure is indicated by a pressure gauge graduated in units of acceleration. Natural vibrations of the system are damped by air damper *5*, consisting of piston *9* and link *10* which is connected by turning pairs *K* and *M* to piston *9* and to lever *3*.

4073	LINKWORK MECHANISM OF AN ACCELEROMETER	EHP M



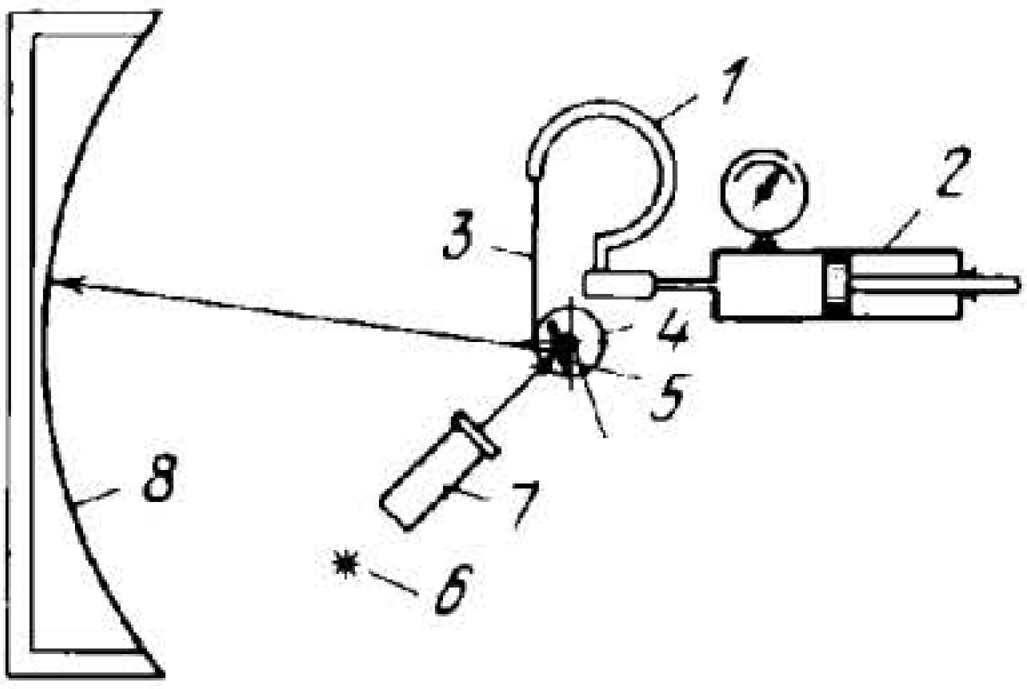
U-tube 1 of the chamber is filled with mercury, the level being at the same height in both branches. In measuring linear acceleration, the column of mercury in tube 1 is displaced by inertia, thereby displacing the water on top of the mercury. This forces a certain additional amount of water into one of the elastic tubes, 2 or 3. The deformation of these tubes, caused by the change in pressure, is transmitted by intermediate link 6, connected by turning pairs B and C to link 4 and to lever 5. Lever 5 turns about fixed axis A, and its hand a has a pen which records the readings of the instrument on a paper chart fastened to drum 7. Drum 7 rotates about fixed axis D. The motion of the hand depends upon the measured linear acceleration.

4074	GAS ANALYZER MECHANISM WITH A PRESSURE REGULATOR	EHP M



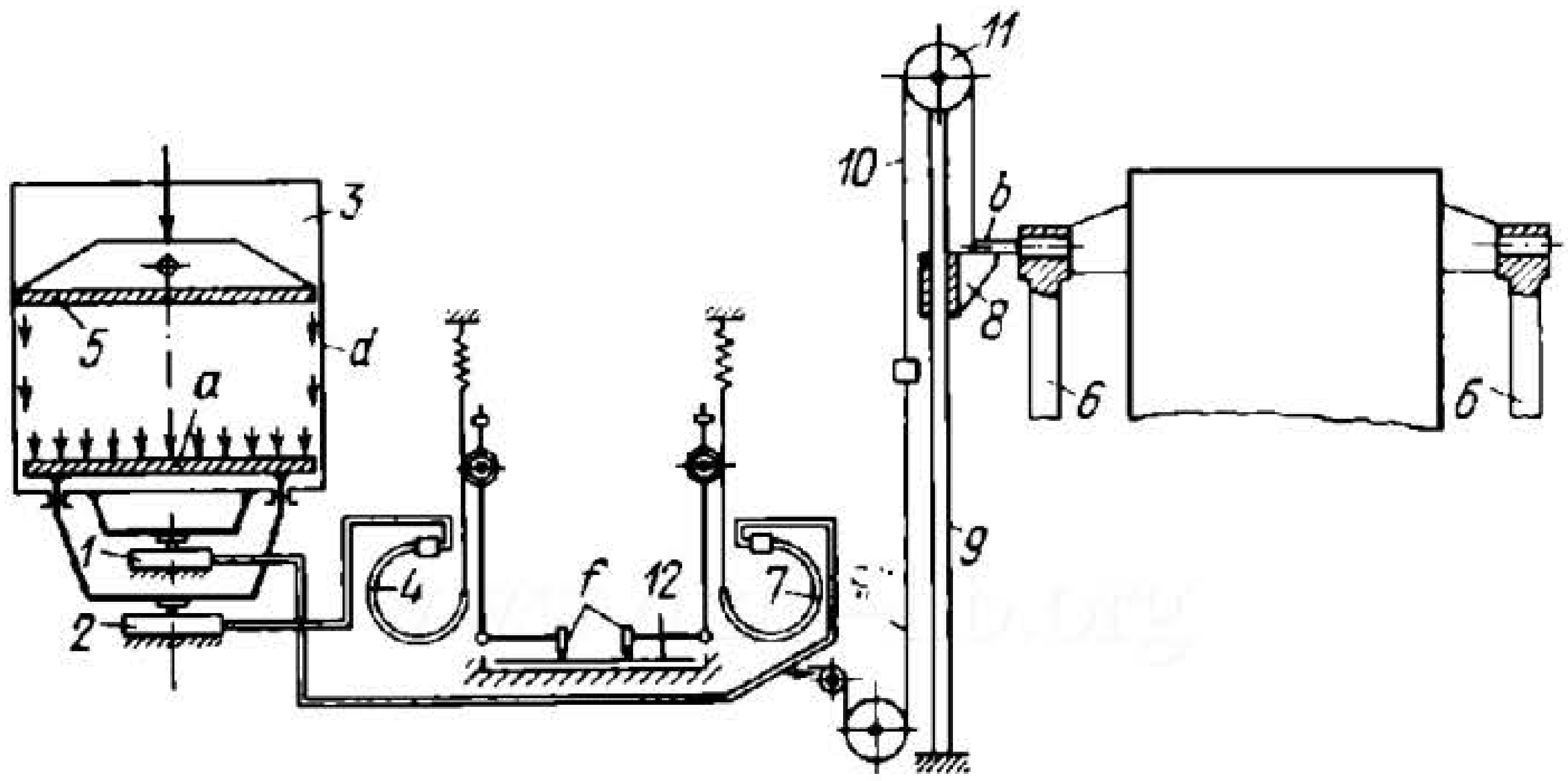
The gas being investigated passes in a continuous stream through pipeline *1*. A part of the gas, passing through valve *2*, enters tube *3* in which diaphragm *4* is mounted. The pressure regulator, consisting of membrane *5* linked to valve *2*, maintains a constant pressure drop over membrane *4* and, consequently, a constant flow of gas through the membrane. The pressure is adjusted by changing the compression of spring *7*. Following diaphragm *4*, the gas passes through an absorbing liquid in a vessel and the remainder is released through the hole in diaphragm *6* to the atmosphere. The pressure of the gas before diaphragm *6*, measured by pressure gauge *8*, depends upon the amount of the component to be determined, initially contained in the gas and absorbed by the liquid.

4075	MECHANISM OF AN INSTRUMENT FOR DETERMINING THE PROPORTIONALITY LIMIT OF BOURDON TUBES	EHP M



Tube 1, to be tested, is connected to the cylinder of pressure device 2. The movable end of tube 1 is connected through flexible link 3 to pulley 4 which turns about a fixed axis. Pulley 4 is mounted on and turns with an axle. Also mounted on this axle is mirror 5 on which light from lamp 6 falls after passing through collimator tube 7. The beam of light is reflected by mirror 5 onto scale 8. When the pressure is increased by pressure device 2, tube 1 tends to straighten out and the motion of its free end turns pulley 4 and mirror 5. Increasing the pressure by equal intervals and noting the corresponding displacement of the beam of light, the pressure can be found, beyond which the increment in the readings noticeably increases, deviating from a linear law. The pressure corresponding to this point is the sought limit of proportionality of the Bourdon tube.

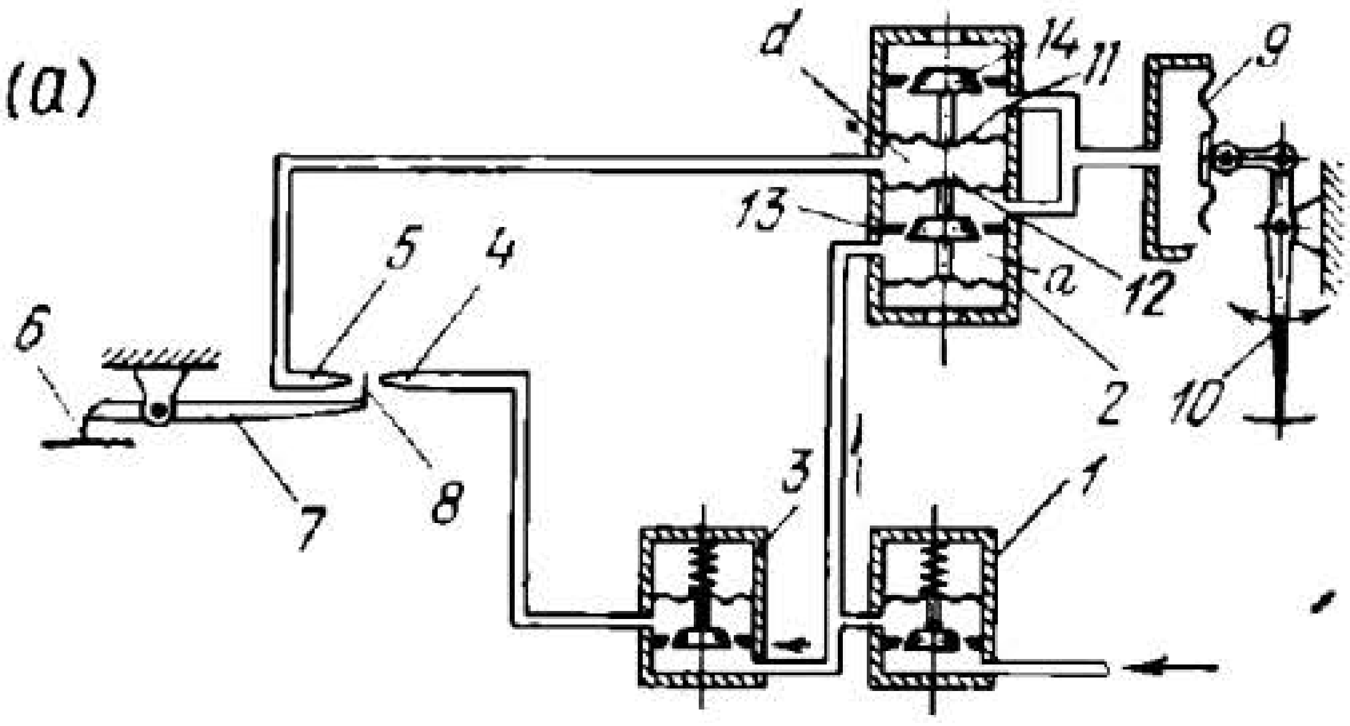
4076	MECHANISM OF THE PUSTYGIN INSTALLATION FOR INVESTIGATING THE HAY PRESSING PROCESS	EHP M



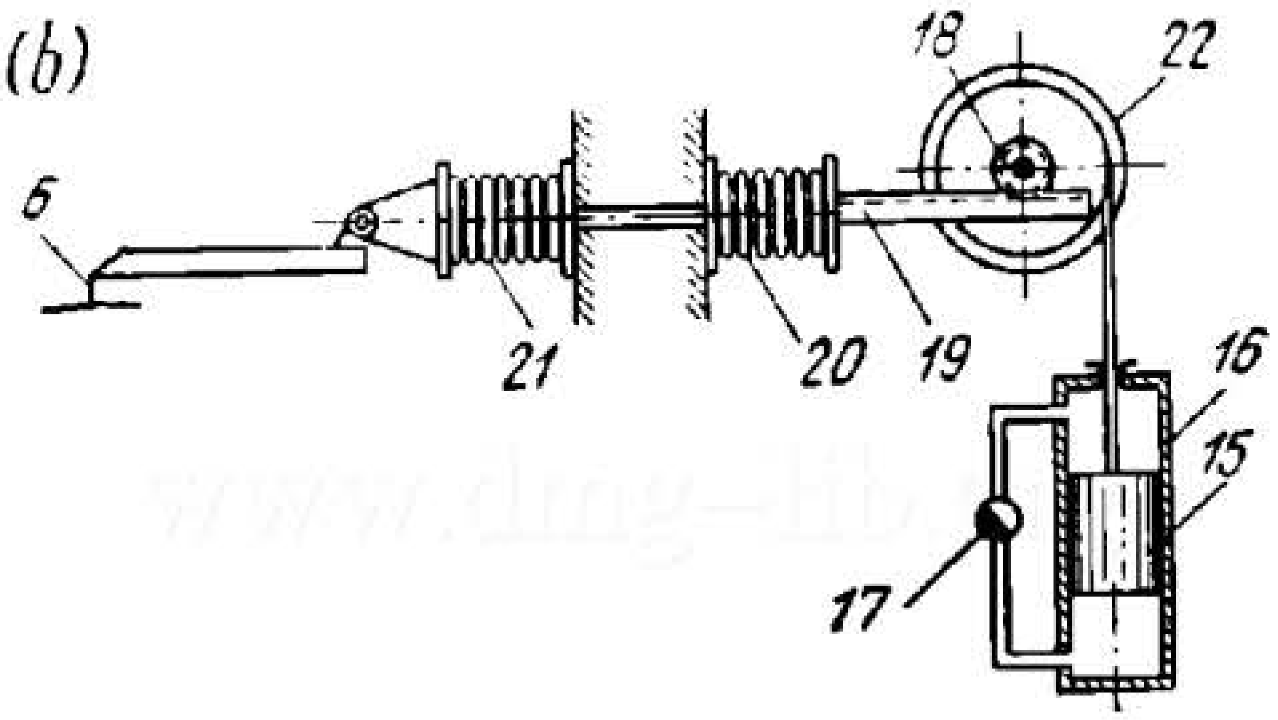
Hydraulic capsule *2* is subject to the force acting on bottom *a* of pressing chamber *3*, and hydraulic capsule *1* is subject to the force of friction between the hay being pressed and the walls of pressing chamber *3*. During the hay pressing operation, accomplished by ram *5* which is driven by connecting rods *6*, the liquid in the hydraulic capsules is compressed, deforming Bourdon tubes *4* and 7, connected to the capsules. The movement of the free ends of the tubes is transmitted to pens *f*, recording the pressures on chart paper. Motion of the ram is transmitted by pin *b* to slider *8* which travels along guide column *9*. At this, flexible link *10*, running over pulley *11*, moves the strip of chart paper *12*.

4077	PNEUMATIC INSTRUMENT MECHANISM FOR SURFACE ROUGHNESS MEASUREMENT	EHP M

(a)

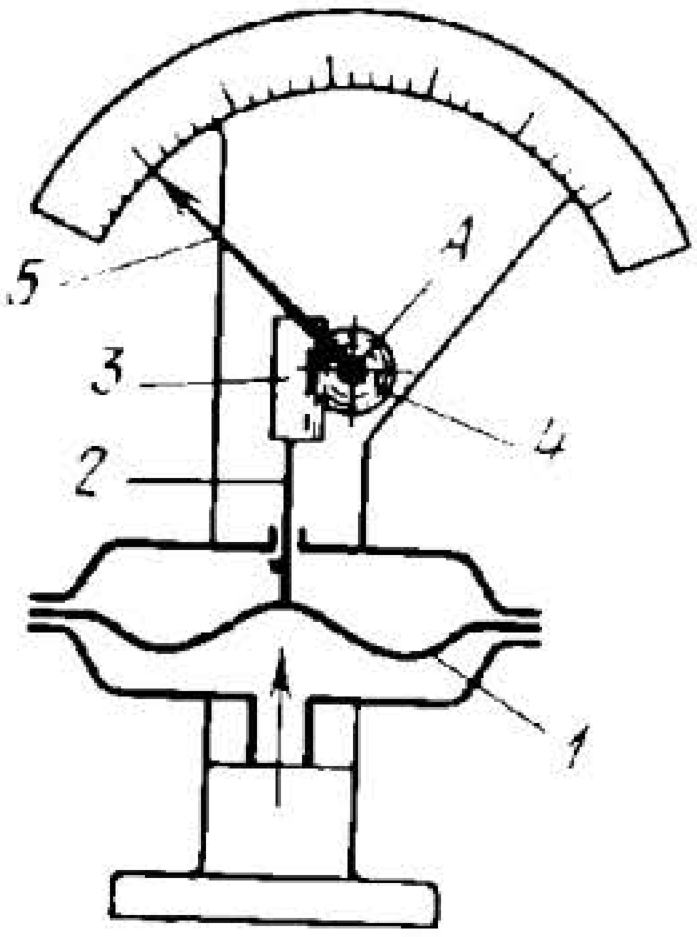


(b)



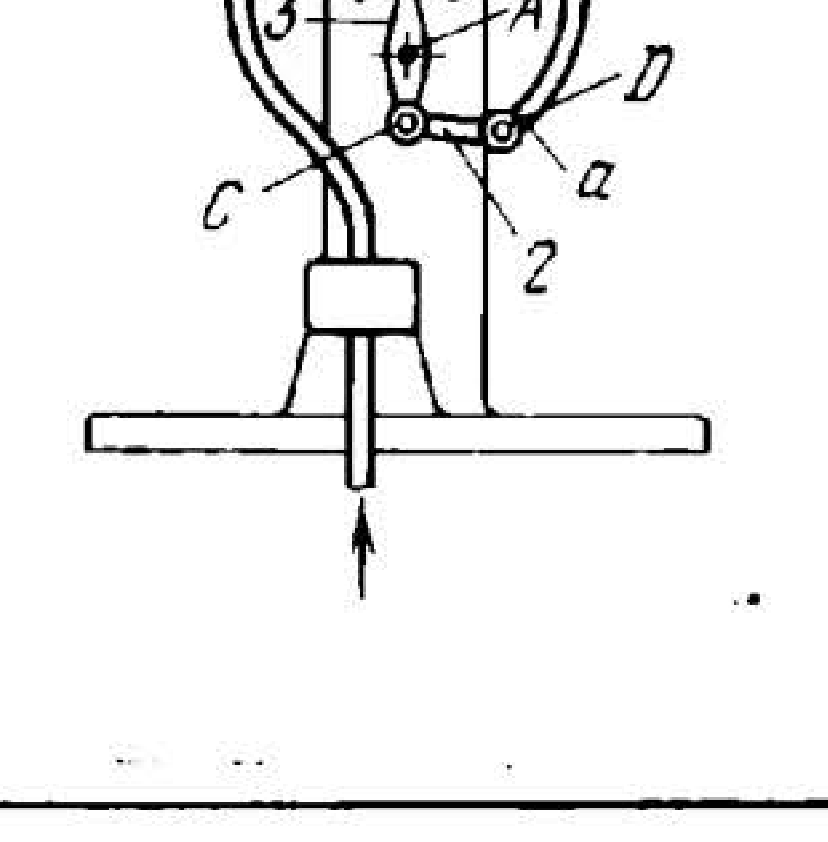
After passing through pressure reducer *1* (see Fig. *a*) in which its pressure is reduced, the compressed air is divided into two streams. Part of the air passes into external chamber *a* of pneumatic relay *2*; the rest passes through second pressure reducer *3* and is delivered to nozzle *4* and further, through nozzle *5*, to internal chamber *d* of relay *2*. Surface irregularities are traced by stylus *6* mounted on lever *7*. The movements of stylus *6* are transmitted to plate *8* which interrupts air flow from nozzle *4* into nozzle *5* and relay *2*. The fluctuations of pressure in relay *2* are sensed by membrane *9* which is linked by levers to pen *10*. Upon a drop in pressure in internal chamber *d* of relay *2*, membranes *11* and *12* are bent inward. At this, valve *13* shuts off air flow to external chamber *a* and valve *14* connects the chamber to the atmosphere. Membrane *9* bends inward, moving the pen to the right. Upon an increase in pressure in internal chamber *d*, pen *10* moves to the left. Stylus travel over the surface being tested is accomplished by weight *15* (see Fig. *b*); the speed of travel being varied by piston-type regulator *16* which has flow-control valve *17*. The motion of the weight is transmitted to drum *22*, which feeds the paper chart, and to stylus *6* through pinion *18* and rack *19*, as well as two bellows, *20* and *21*, filled with liquid.

4078	**MEMBRANE PRESSURE GAUGE MECHANISM**	EHP M



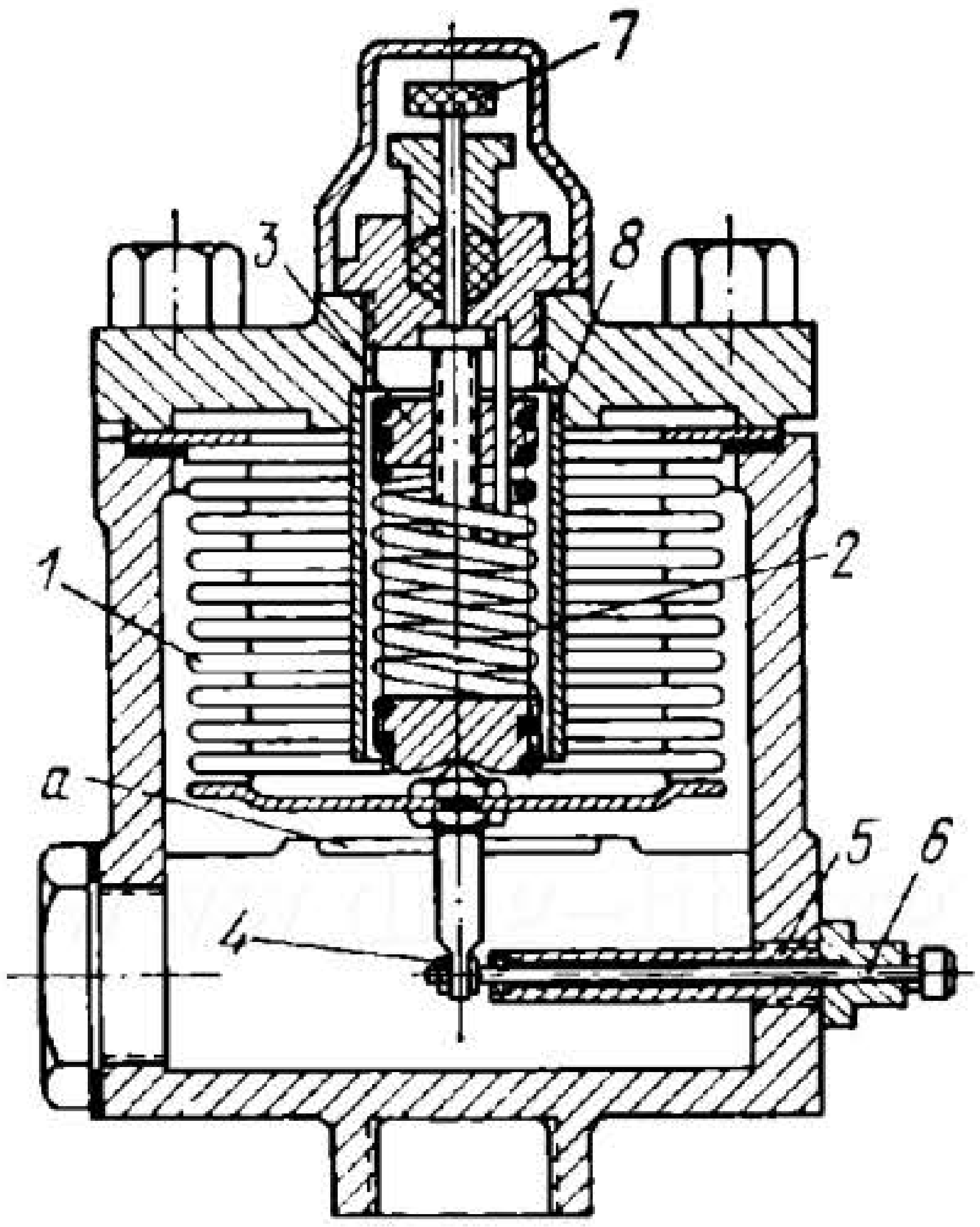
When the pressure inside the pressure gauge increases, membrane *1* bends upward, raising link *2* and rack *3* which turns pinion *4* about fixed axis *A*. Hand *5* is rigidly attached to pinion *4*.

4079	**DIFFERENTIAL PRESSURE GAUGE MECHANISM**	EHP M



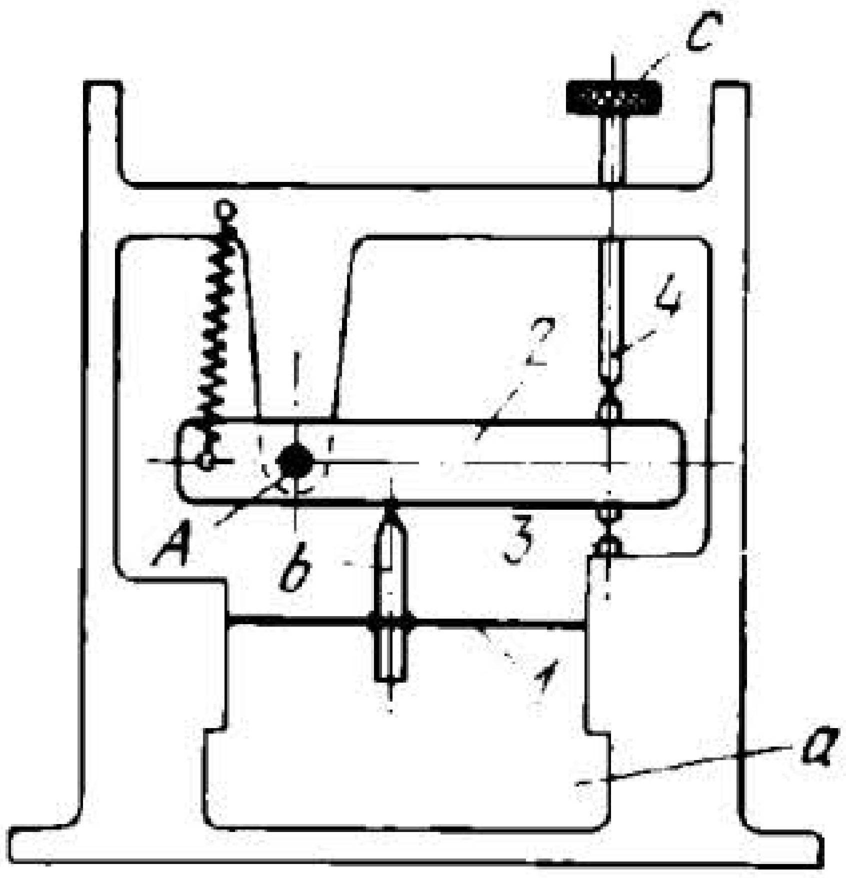
The vessel with the pressure to be measured is connected to Bourdon tube *1*. End *a* of spiral tube *1* is sealed shut and is linked by member *2* to lever *3*. Member *2* is connected by turning pairs *D* and *C* to tube *1* and to lever *3*, which turns about fixed axis *A* and has segment gear *b*. Segment gear *b* of lever *3* meshes with pinion *4* which turns about fixed axis *B* and is rigidly attached to hand *5*. When the pressure is increased, tube *1* tends to straighten out, its sealed end *a* moves to the right, member *2* turns lever *3* with segment gear *b* which turns pinion *4* and hand *5* along scale *d*.

DIFFERENTIAL PRESSURE GAUGE MECHANISM



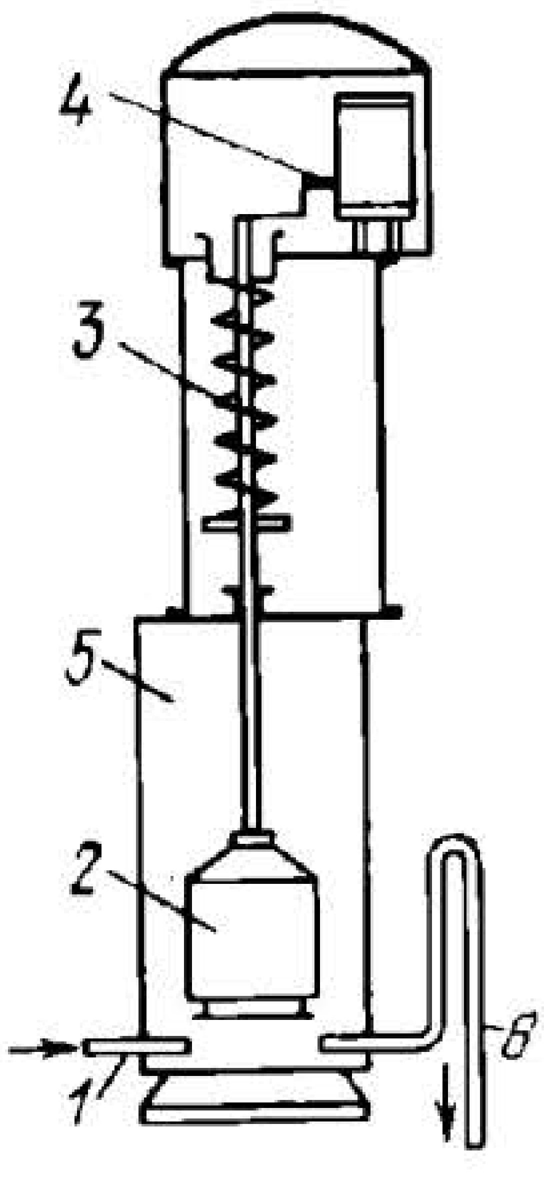
Gas at the higher pressure is delivered into the lower chamber of the gauge where it applies a force on the bottom of bellows *1*. Gas at the lower pressure is delivered into the bellows. The difference in the pressures acting on the bottom of the bellows is counterbalanced by spring *2* whose number of active coils can be varied by turning insert *3*. Owing to the pressure difference, the bellows is compressed and, by means of lever *4*, it turns shaft *6*. This shaft is brought out through seal *5* and is linked to a mechanism which operates the shutter of the regulator. The instrument is zeroed by adjusting screw *7*. The motion of the bellows is restricted by sleeve *8* and by boss *a* of the gauge housing.

4081	PRESSURE LIMITER MECHANISM WITH AN ELASTIC MEMBRANE	EHP M



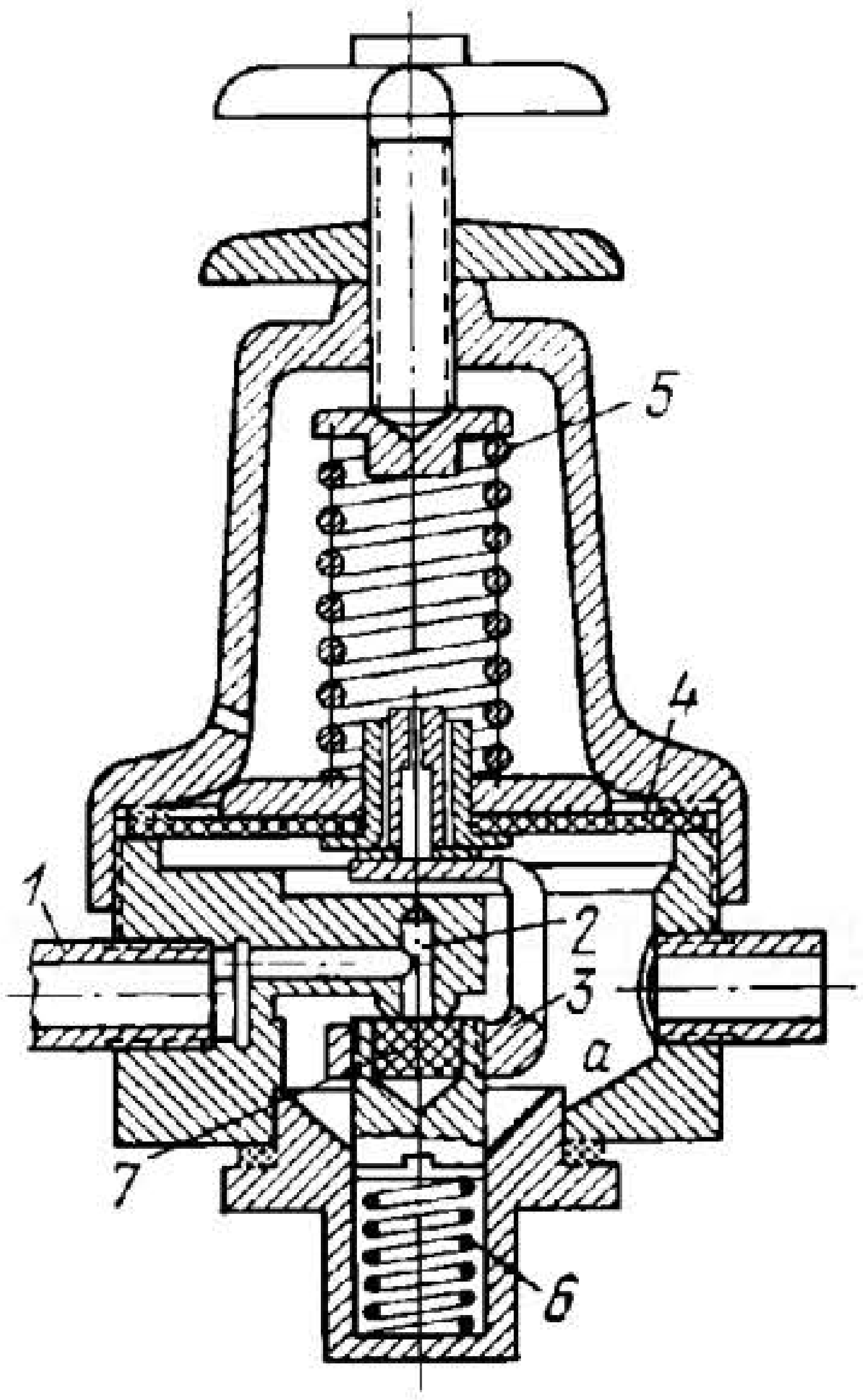
When the air pressure increases or decreases in chamber *a*, membrane *1*, to which pin *b* is fastened, is bent outward or inward. Pin *b* actuates contact lever *2*, turning about fixed axis *A*, so that the lever makes contact with either upper terminal *4* or lower terminal *3*. The terminals are adjusted to the required pressure by screws *c*. Terminals *3* and *4* are connected to an electropneumatic device which regulates the air pressure.

4082	AUTOMATIC LIQUID DENSITY RECORDER MECHANISM	EHP M



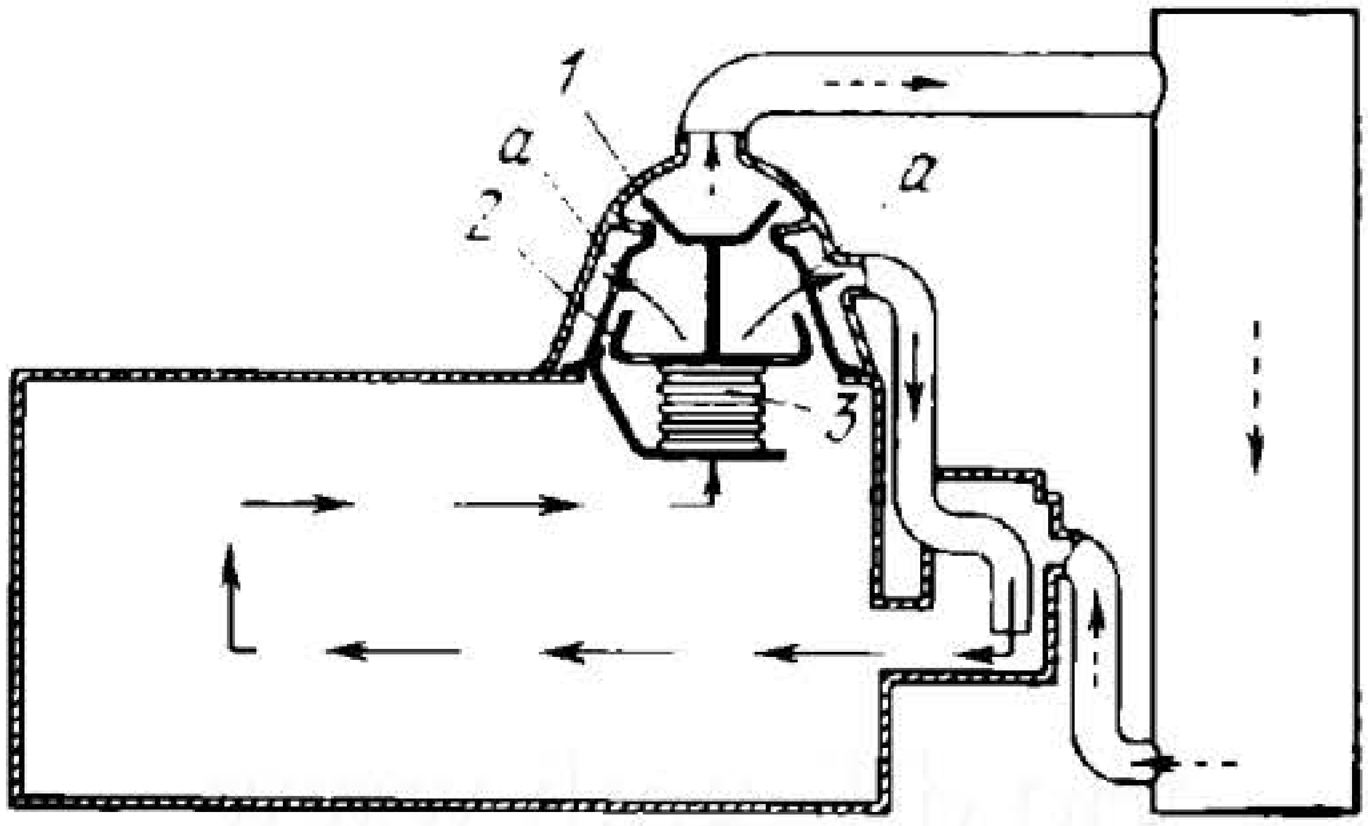
Float *2* is suspended on helical spring *3* whose force counterbalances the buoyant force of the float. When the liquid to be tested is delivered through input tube *1*, recording pen *4* draws a line whose length corresponds to the density of the liquid. The instrument operates periodically. When vessel *5* is filled with the liquid to the height of the top bend of siphon *6*, the liquid begins to empty the vessel through the siphon. After vessel *5* has been completely emptied by siphon *6*, it begins to fill again.

PRESSURE REDUCER MECHANISM WITH AN ELASTIC MEMBRANE



High-pressure air is delivered along pipe *1* and through nozzle *2* into chamber *a* of the reducer. As the pressure increases, membrane *4* bends upward, overcoming the resistance of spring *5*. As a result, spring *6* lifts shackle *3*, and the input nozzle is closed by rubber disk *7* (as shown). When the pressure drops, membrane *4* is bent downward by spring *5*, so that shackle *3* opens nozzle *2* slightly. At this, the pressure in chamber *a* increases to the required value.

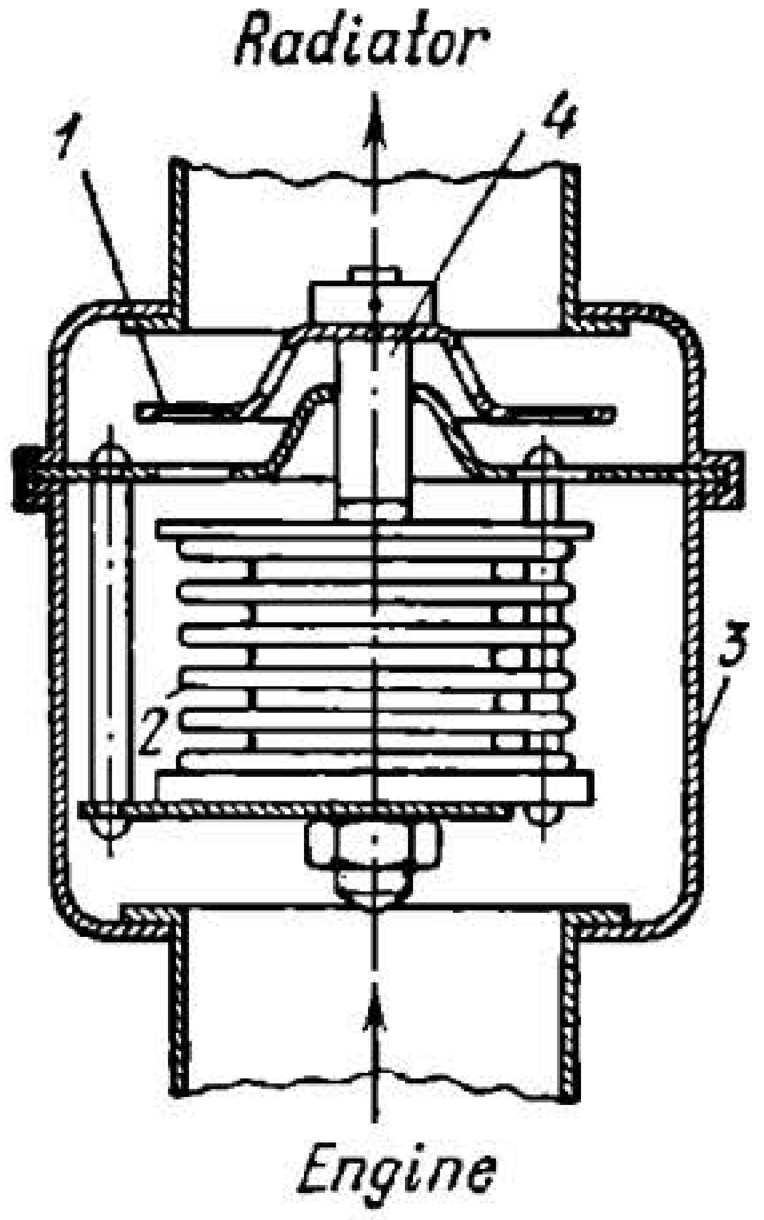
4084	TWO-VALVE THERMOSTAT MECHANISM FOR AN AUTOMOBILE	EHP Rg



The thermostat, serving to maintain constant temperature of the cooling water, consists of two valves, *1* and *2*, and bellows *3*, rigidly attached to the valves and filled with a low-boiling liquid. Until the engine heats up, upper valve *1* remains closed and lower valve *2* opens holes *a* to allow water to flow through. When the engine has become heated and the temperature of the cooling water is above the required value, the liquid in the bellows boils. The increased pressure stretches the bellows, opening valve *1* and simultaneously closing valve *2*. Then the water circulates through the radiator in the direction indicated by the dash-line arrows.

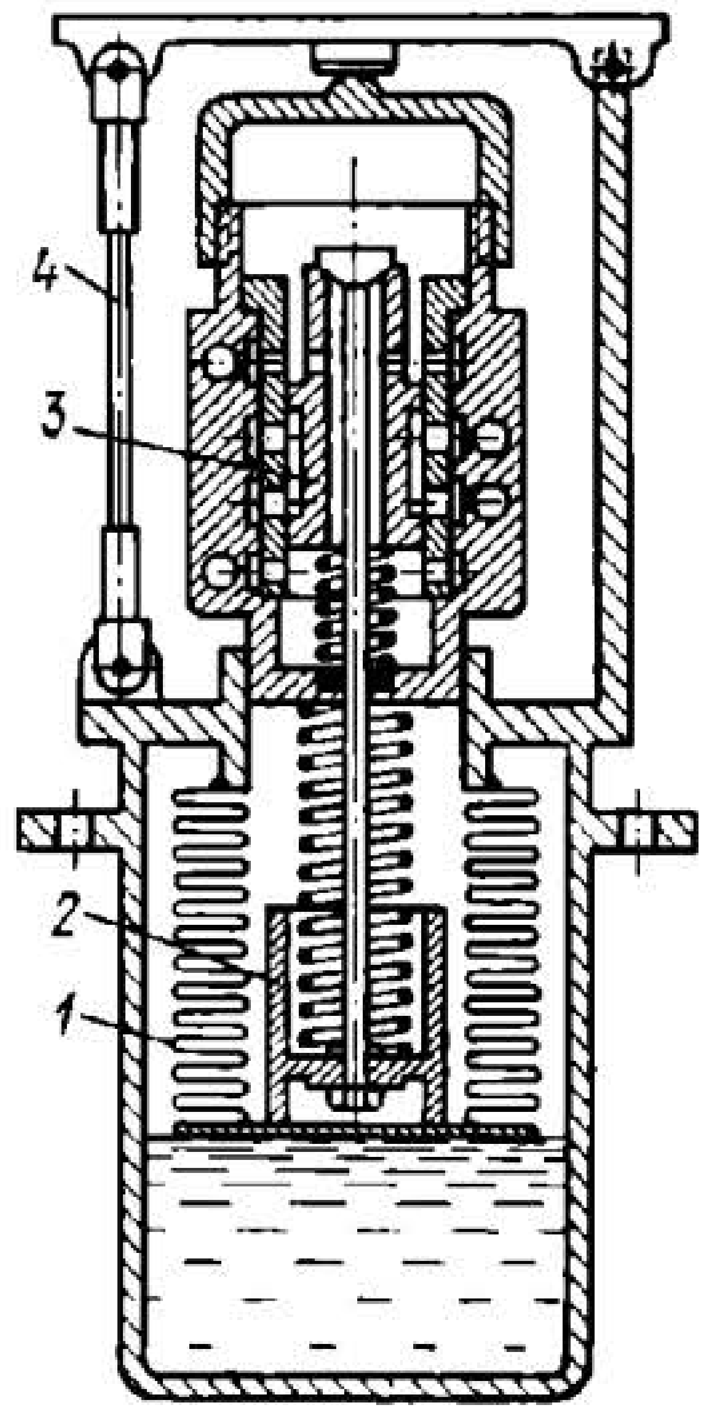
4085	SINGLE-VALVE THERMOSTAT MECHANISM FOR AN AUTOMOBILE	EHP Rg

The thermostat, serving to maintain constant temperature of the cooling water, consists of valve 1, reducing the clear opening of the water outlet connection, and bellows 2, filled with a low-boiling liquid. At a temperature below the preset value, the valve remains closed and water does not circulate through the radiator. As the temperature increases inside thermostat housing 3, the liquid in the bellows boils. The increased pressure stretches the bellows which, by means of stem 4, lifts valve 1, admitting the water into the radiator.

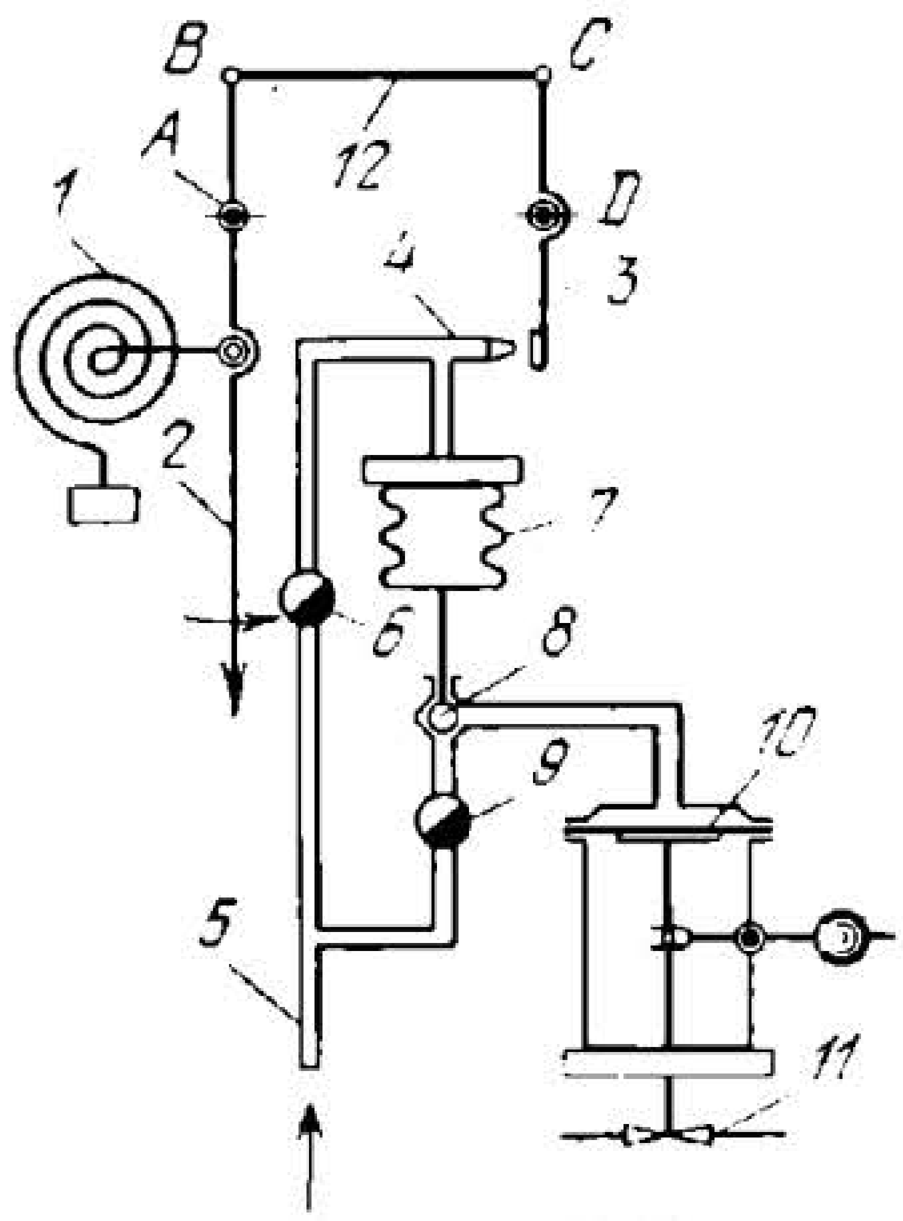


4086	AIRCRAFT RADIATOR FLAP THERMOSTAT MECHANISM	EHP Rg

When the temperature of the medium surrounding bellows 1 drops, the volume of the liquid with which the bellows is filled changes, deforming the bellows and moving piston 2. Valve spool 3, rigidly linked to piston 2, shifts downward. The fluid delivered by the pump to the valve is directed to the power cylinder controlling the radiator flaps. This raises the temperature of the medium. When the temperature increases, the elements of the thermostat operate in the reverse direction. The body of the valve can be adjusted along the axis of the thermostat housing by changing the length of regulating tie-rod 4. This controls the motion of the flaps and the temperature of the coolant.

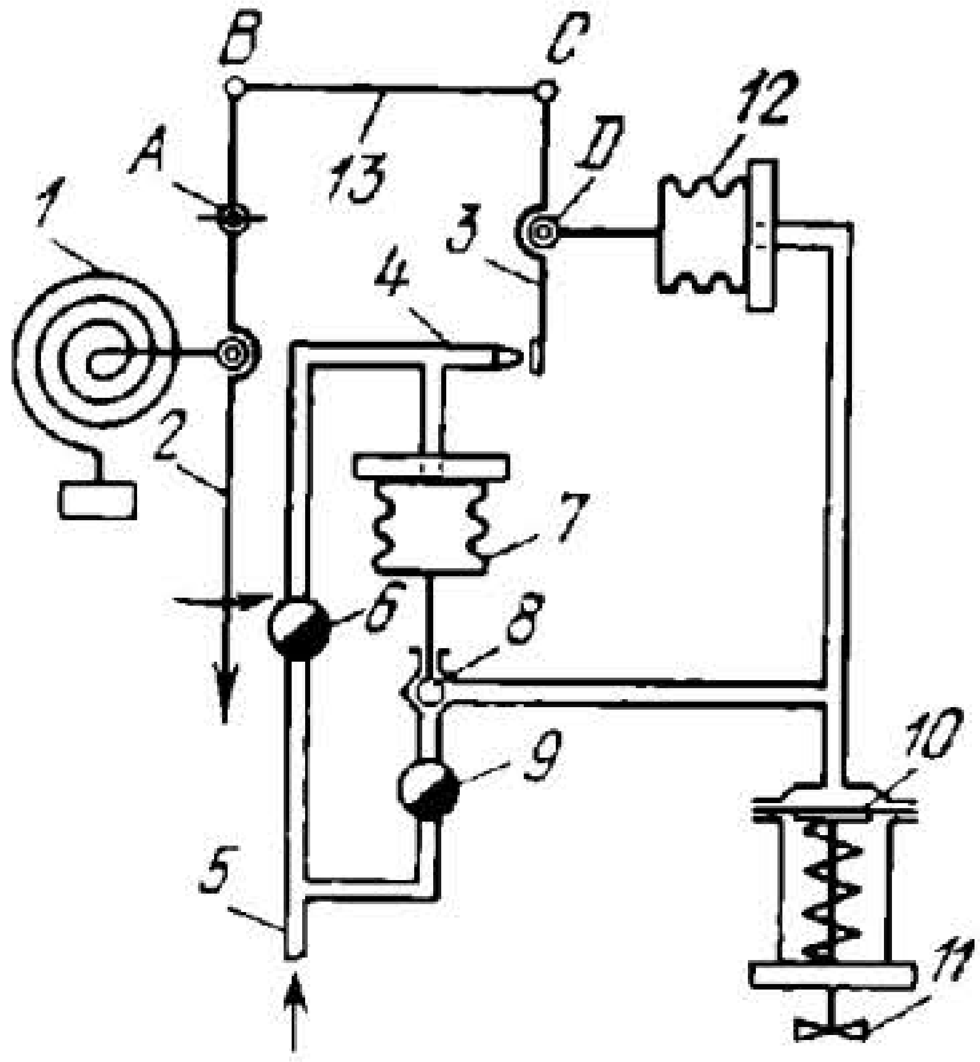


4087	PRESSURE REGULATOR MECHANISM	EHP Rg



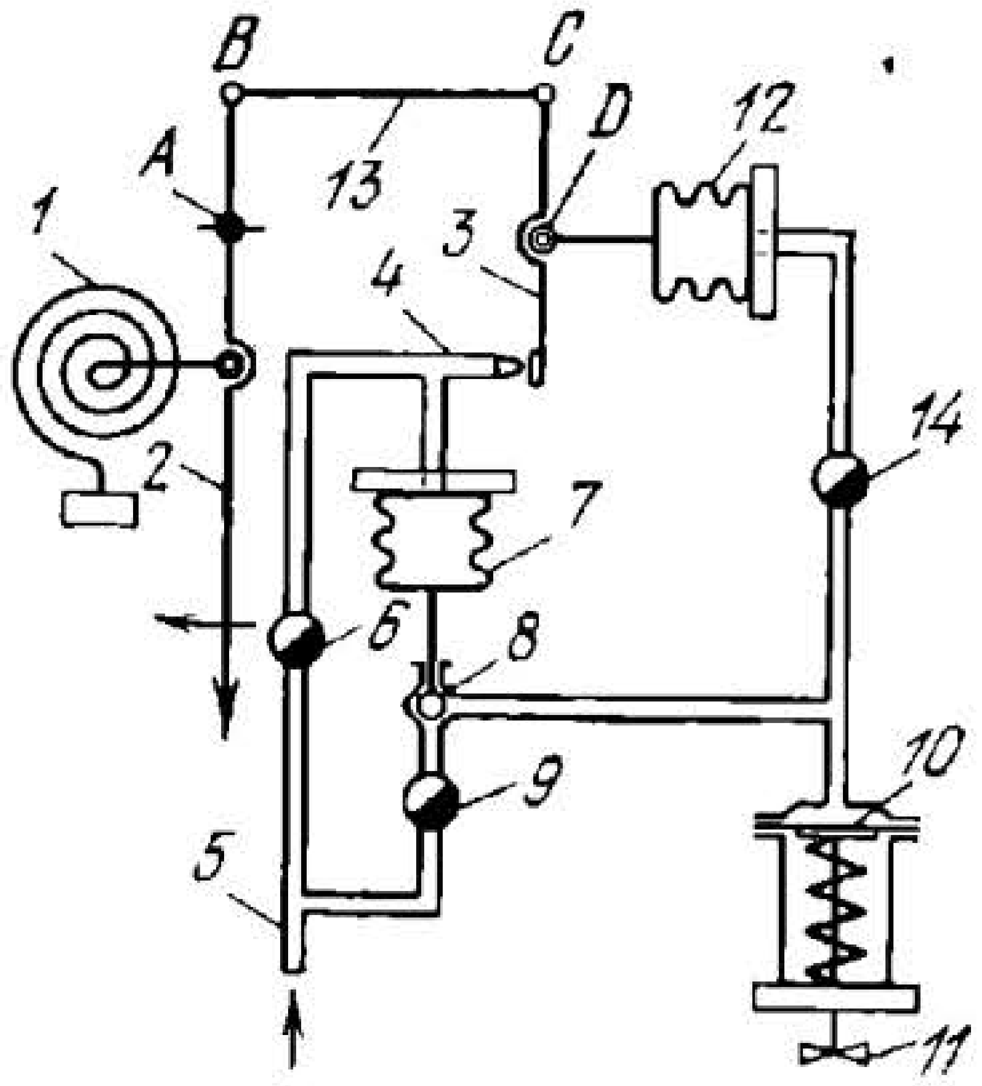
Hand *2*, turning about fixed axis *A*, is linked to Bourdon tube *1* which is connected to the item whose pressure is to be regulated. Link *12* is connected by turning pairs *B* and *C* to hand *2* and to shutter *3*, which turns about fixed axis *D* and approaches nozzle *4*. Compressed air is delivered through tube *5* and flow-control valve *6* to nozzle *4*. The nozzle is also connected to bellows *7* to which the ball of valve *8* is linked. The air delivered to valve *8* through flow-control valve *9* is at the same pressure as that delivered to nozzle *4*. The chamber of valve *8* is connected to the atmosphere and to the membrane chamber of servomotor *10*. When the pressure rises above normal, hand *2* turns counterclockwise, shutter *3* is retracted from nozzle *4*, the pressure in bellows *7* drops, and the ball of valve *8* is raised, closing off air discharge to the atmosphere. After this, the pressure on the membrane of the servomotor increases and valve *11* is closed to some extent, reducing the supply of the heat-carrying agent to the system. When the pressure in the system drops, hand *2* turns clockwise, shutter *3* approaches nozzle *4*, restricting the flow. This raises the pressure in bellows *7*, lowering the ball of valve *8* and reducing the flow of air to the servomotor whose membrane chamber is connected to the atmosphere. Valve *11* is opened by the weight and it increases the supply of heat-carrying agent to the system.

4088	PRESSURE REGULATOR MECHANISM WITH DIRECT FEEDBACK	EHP Rg



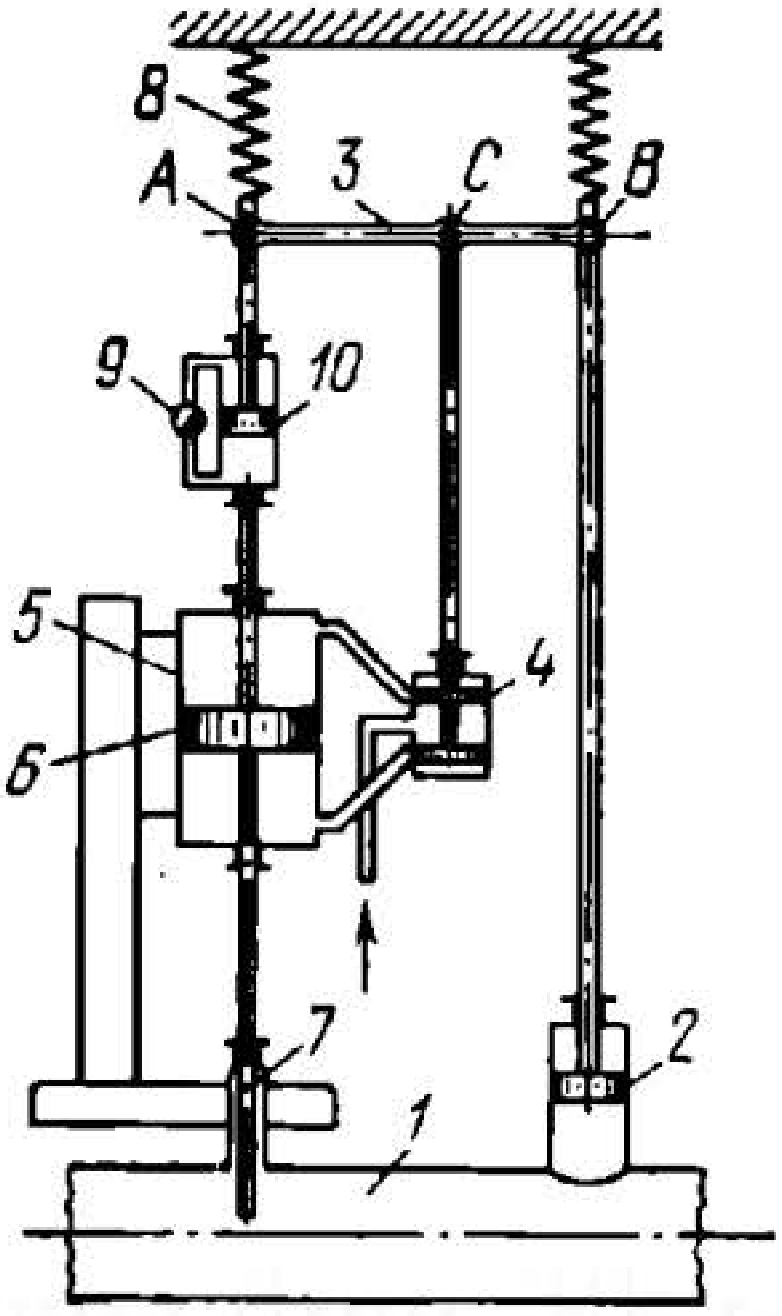
Hand 2, turning about fixed axis A, is linked to Bourdon tube 1 which is connected to the item whose pressure is to be regulated. Link 13 is connected by turning pairs B and C to hand 2 and to shutter 3 which turns about axis D, attached to bellows 12, and approaches nozzle 4. Compressed air is delivered through tube 5 and flow-control valve 6 to nozzle 4. The nozzle is also connected to bellows 7 to which the ball of valve 8 is linked. The air delivered to valve 8 through flow-control valve 9 is at the same pressure as that delivered to nozzle 4. The chamber of valve 8 is connected to the atmosphere and to the membrane chamber of servomotor 10. When the pressure rises above normal, hand 2 turns counterclockwise, shutter 3 is retracted from nozzle 4, the pressure in bellows 7 drops, and the ball of valve 8 is raised, closing off air discharge to the atmosphere. After this, the pressure on the membrane of servomotor 10 increases and valve 11 is closed to some extent, reducing the supply of heat-carrying agent to the system. At the same time, the increased pressure stretches bellows 12, returning shutter 3 to its previous position. As a result, the ball of valve 8 is lowered and the pressure in servomotor 10 is stabilized. When the pressure in the system drops, the elements of the regulator operate in the reverse direction.

4089	PRESSURE REGULATOR MECHANISM WITH DIRECT FEEDBACK	EHP Rg



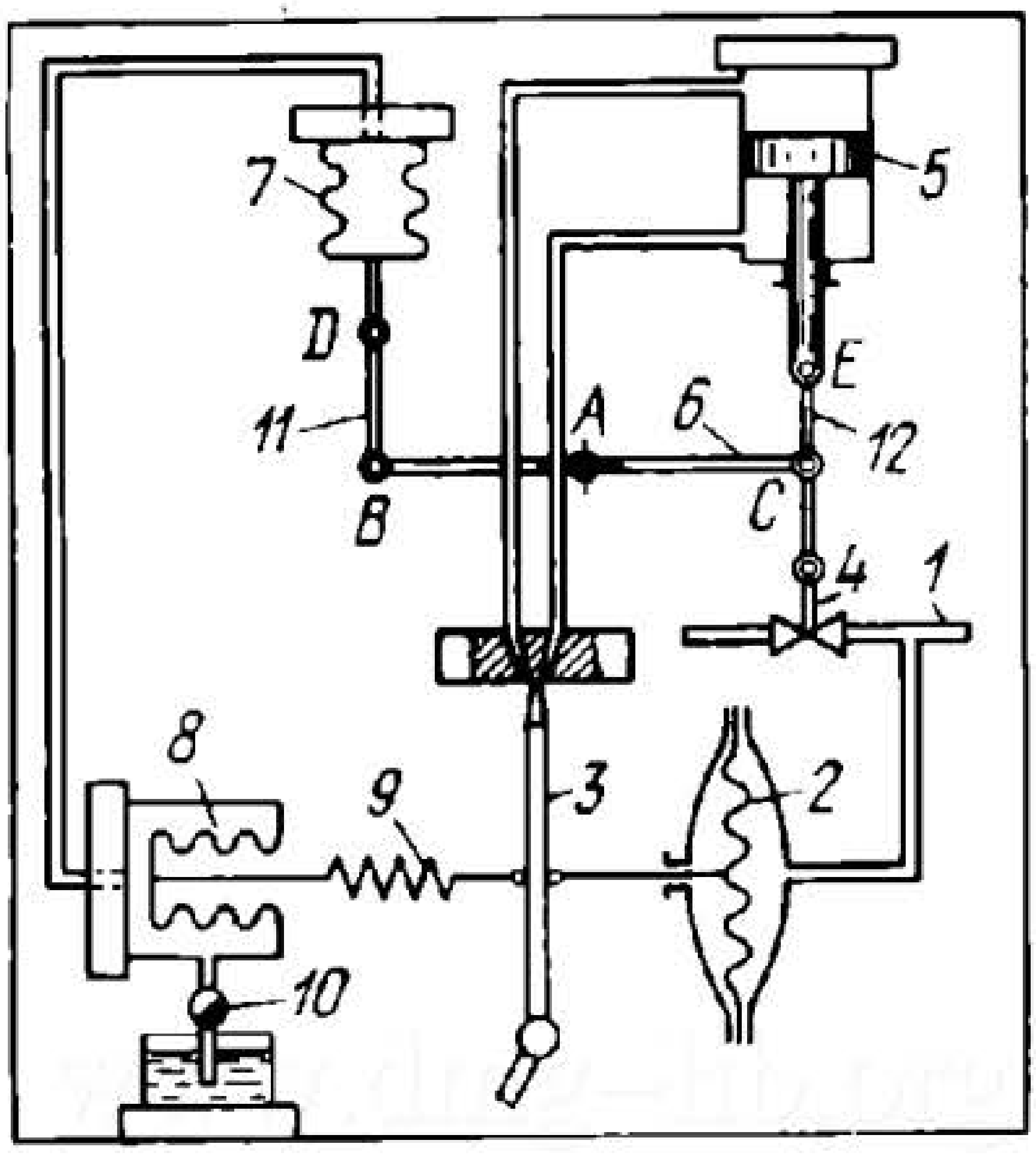
Hand 2, turning about fixed axis A, is linked to Bourdon tube *1* which is connected to the item whose pressure is to be regulated. Link *13* is connected by turning pairs B and C to hand *2* and to shutter *3* which turns about axis D, attached to bellows *12*, and approaches nozzle *4*. Compressed air is delivered through tube *5* and flow-control valve *6* to nozzle *4*. The nozzle is also connected to bellows *7* to which the ball of valve *8* is linked. Air is delivered through flow-control valve *9* to valve *8* whose chamber is connected to the atmosphere and to the membrane chamber of servomotor *10*. When the pressure drops in the item being regulated, hand *2* turns clockwise, shutter *3* approaches nozzle *4*, the pressure in bellows *7* increases, and the ball of valve *8* is lowered, connecting the membrane chamber of servomotor *10* to the atmosphere. This reduces the pressure on the membrane and valve *11* is opened to some extent, increasing the supply of the heat-carrying agent to the system. Bellows *12* is connected to the membrane chamber of servomotor *10* through flow-control valve *14*. For this reason, the pressure in bellows *12* drops with a certain lag, during which the pressure on the membrane of servomotor *10* continues to remain less than it would be with ordinary operation of a feedback bellows, i.e. one without flow-control valve *14*. With this arrangement, regulating valve *11* first greatly increases the supply of heat-carrying agent, thereby tending to decrease a subsequent deviation of the parameter being regulated and reducing the length of the transient state. Flow-control valve *14* can influence the rate of the regulating process. When the pressure in the system increases, the elements of the regulator operate in the reverse direction.

4090	PRESSURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



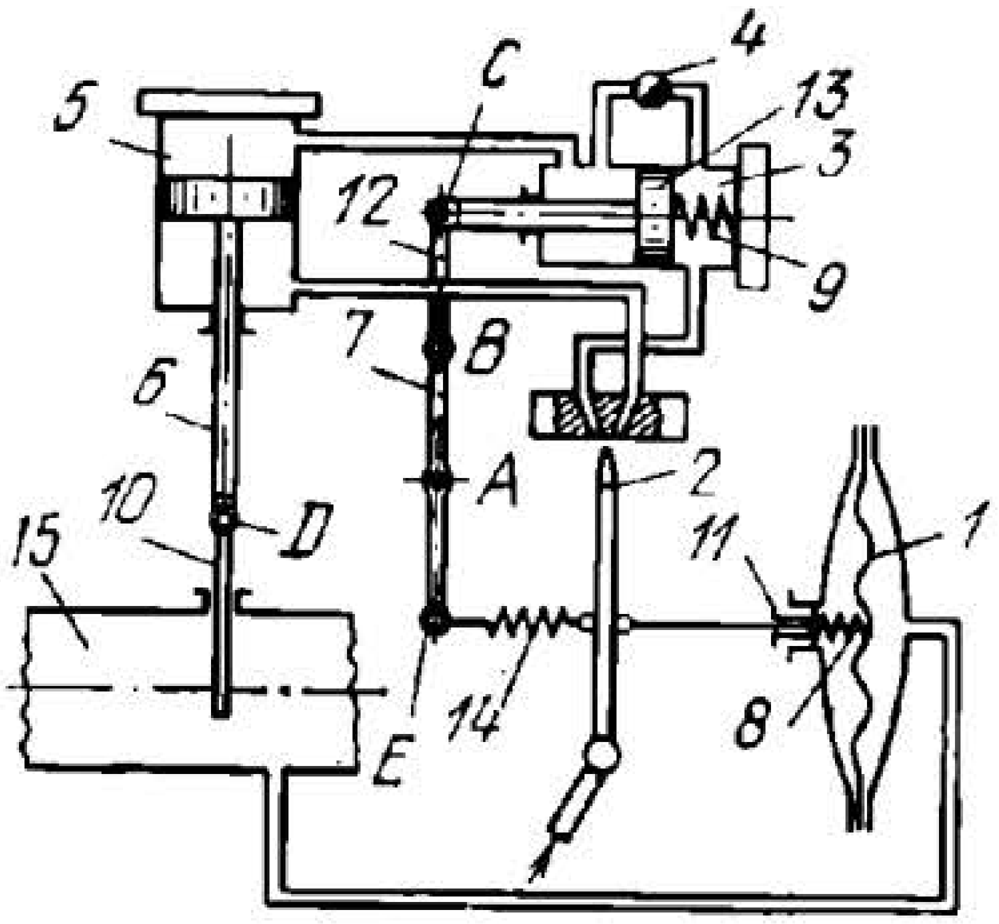
Lever *3*, suspended on springs *8*, is connected by turning pairs *A*, *C* and *B* to the rods of cataract piston *10*, spool *4* and piston *2*. When the pressure increases in pipeline *1*, piston *2* moves upward and, by means of lever *3*, shifts spool *4* upward so that fluid is delivered to the upper end of cylinder *5*. Piston *6*, together with shutter *7*, begins to descend. Descending simultaneously are cataract *10*, designed as a cylinder containing a piston that divides it into two chambers connected together through flow-control valve *9*, and point *A* of lever *3*. This stretches left spring *8* somewhat. As point *A* is lowered, lever *3* turns about point *B*, moving point *C* and spool *4* downward. After a certain time has passed, spool *4* reaches its central (neutral) position and the downward motion of shutter *7* stops. This establishes a new position of equilibrium, but at a pressure somewhat higher than the specified value. To return the pressure to the specified value, the action of cataract *10* is made use of. Owing to the tension of left spring *8*, the pressure in the upper end of the cataract cylinder is somewhat higher than in the lower end, and the fluid begins to flow to the lower end. At this, the piston of the cataract moves upward with point *A* of lever *3*. Spool *4* moves upward again and shutter *7* descends, additionally reducing the pressure in pipeline *1*. When the pressure drops in pipeline *1*, the elements of the regulator operate in the reverse direction.

4091	PRESSURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



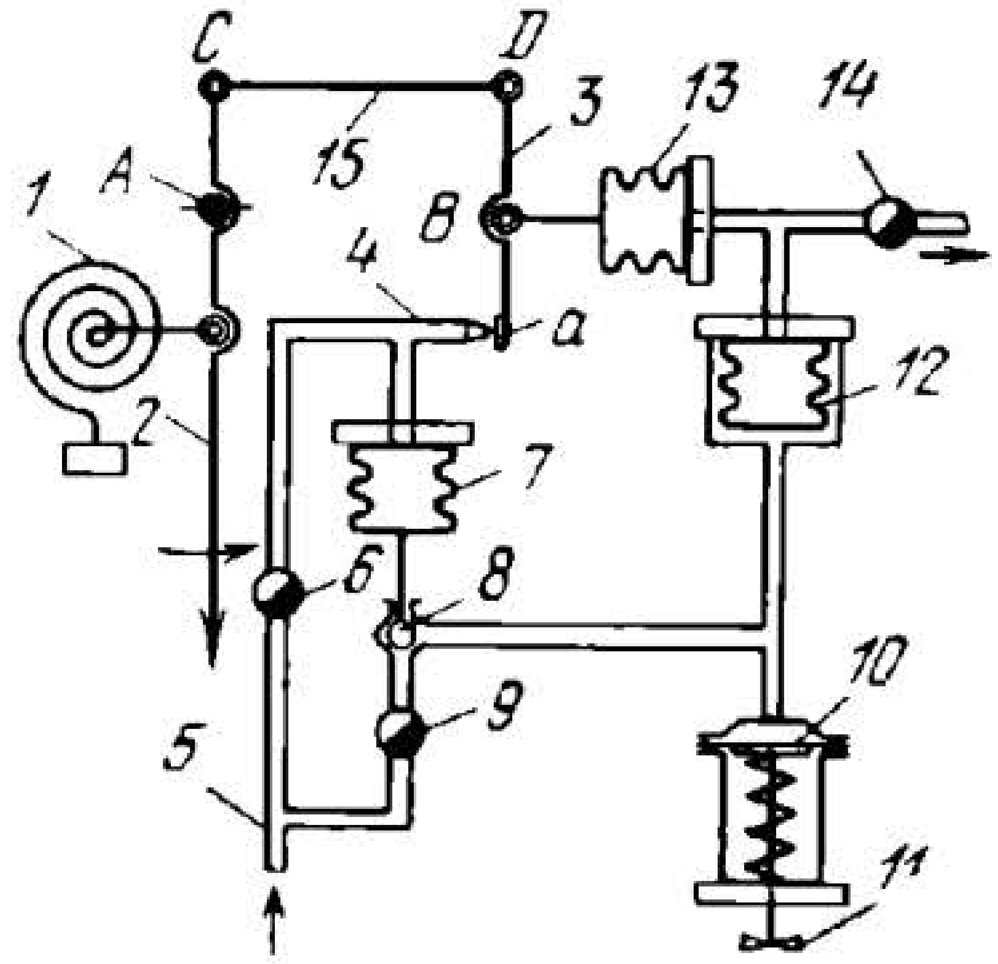
Lever *6* turns about fixed axis *A* and is connected by turning pairs *B* and *C* to links *11* and *12*, which, in turn, are connected by turning pairs *D* and *E* to bellows *7* and to piston *5*. When the pressure increases in pipeline *1*, membrane *2* is bent to the left and diverts jet valve nozzle *3* opposite the left-hand channel so that fluid from the nozzle is delivered to the upper end of the servomotor cylinder. Piston *5* moves downward and closes valve *4* to some extent. At the same time, link *11* compresses bellows *7*. The system consisting of two bellows, *7* and *8*, is filled with fluid and is airtight. The chamber of bellows *8* is connected through flow-control valve *10* to a vessel containing the fluid. When bellows *7* is compressed, the pressure in its chamber increases and this compresses bellows *8* which, through spring *9*, diverts jet nozzle *3* to the right. When the bellows are deformed, the pressure of the fluid in them is increased, so that part of the fluid escapes through flow-control valve *10* and jet nozzle *3* returns to its initial position. When the pressure decreases in pipeline *1*, the elements of the regulator operate in the reverse direction.

4092	PRESSURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



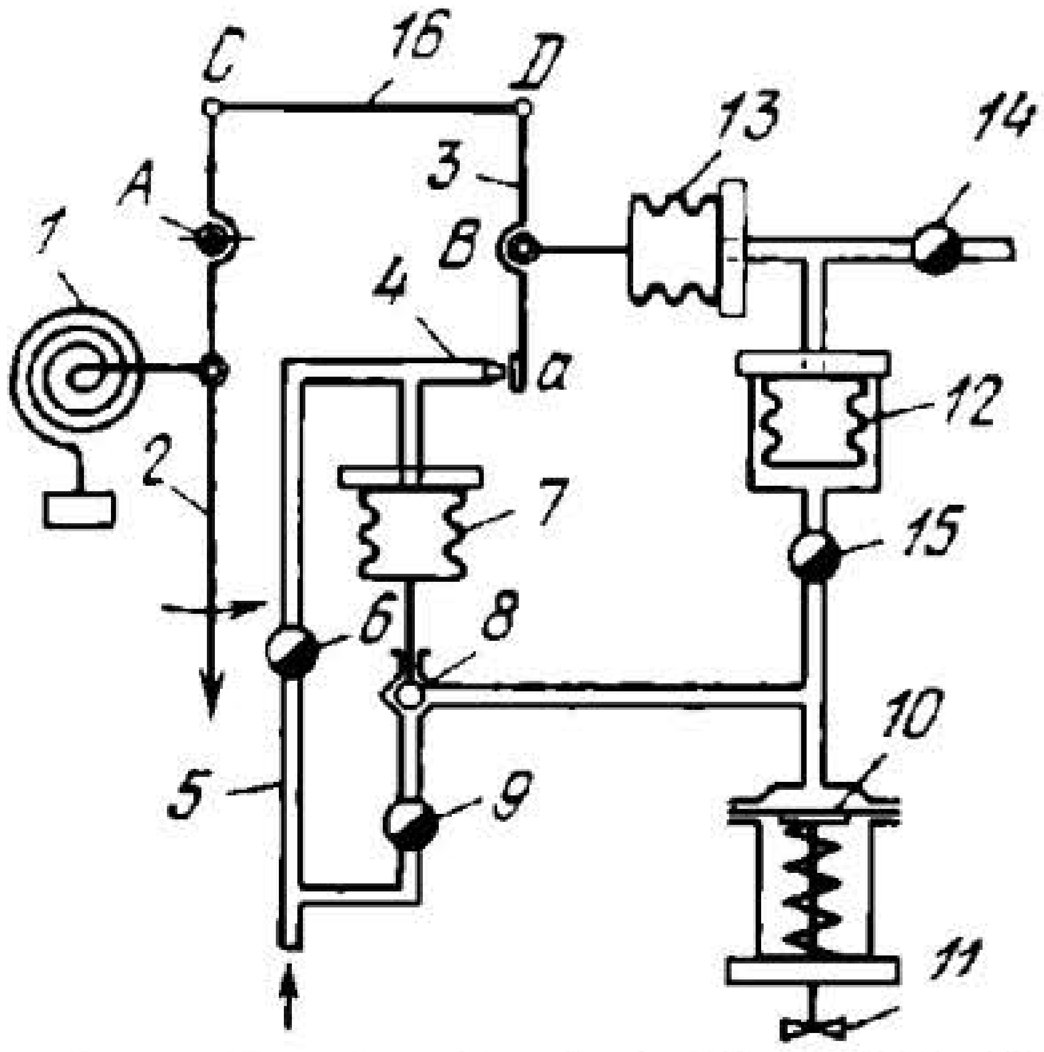
Lever *7* turns about fixed axis *A* and is connected by turning pair *B* to link *12* which is connected by turning pair *C* to the rod of piston *13*. When the pressure increases in pipeline *15*, membrane *1* is bent to the left, diverting jet valve nozzle *2*, linked by spring *14* to point *E* of lever *7*, in the same direction. Fluid from nozzle *2* is delivered to the left-hand channel and to the right end of cylinder *3*. From here part of the fluid flows to the top end of power cylinder *5*, lowering the piston and shutter *10*, connected by turning pair *D* to piston rod *6*. As piston *13* moves to the left, lever *7* diverts jet valve nozzle *2* to the right. As fluid flows through flow-control valve *4*, owing to the action of stretched spring *9*, the servomotor piston (in cylinder *5*) moves downward an additional amount, lowering shutter *10* again. Membrane *1* gradually moves to the right, diverting jet valve nozzle *2* to the right until it reaches its middle position. The required pressure to be maintained in pipeline *15* is set by means of screw *11* which adjusts the force exerted by spring *8* on membrane *1*. When the pressure drops in pipeline *15*, the elements of the regulator operate in the reverse direction.

4093	PRESSURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



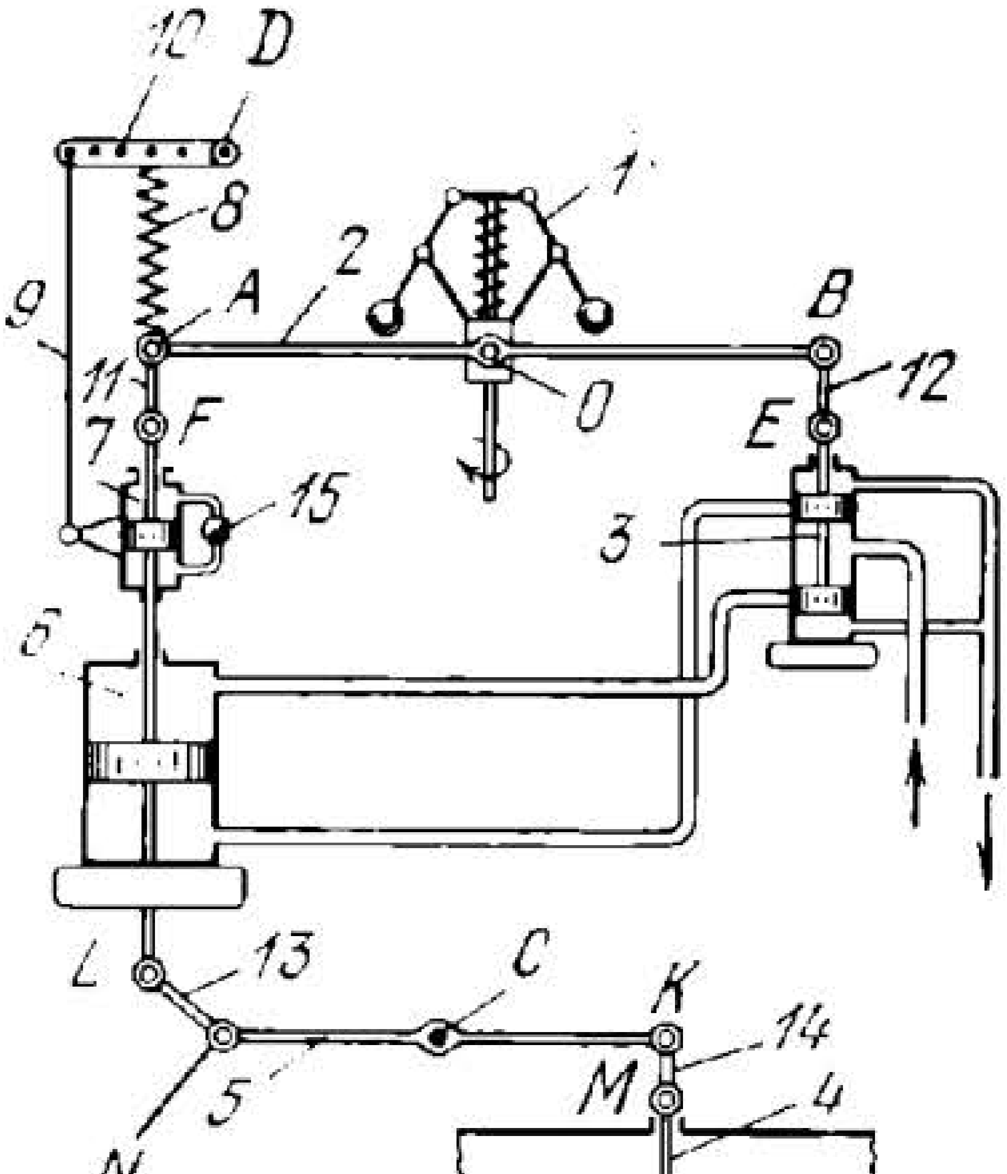
Hand 2, turning about fixed axis A, is linked to Bourdon tube 1 which is connected to the item whose pressure is to be regulated. Link 15 is connected by turning pairs C and D to hand 2 and to lever 3 which, in turn, is connected by turning pair B to the rod of bellows 13 and carries shutter a. When the pressure rises in the item being regulated, hand 2 turns counterclockwise and shutter a is retracted from nozzle 4 to which compressed air is delivered through tube 5 and flow-control valve 6. Compressed air is also delivered through flow-control valve 9 to the chamber of valve 8 whose ball is linked to bellows 7. The chamber of bellows 7 is connected to nozzle 4. The chamber of valve 8 is connected to the atmosphere and to the membrane chamber of servomotor 10. As shutter a is retracted from nozzle 4, the pressure in bellows 7 drops and the ball of valve 8 is raised, closing off air discharge to the atmosphere. After this, pressure on the membrane of servomotor 10 increases and valve 11 is closed to some extent, reducing the supply of heat-carrying agent to the system. The increase in pressure compresses bellows 12. At this, bellows 13 is stretched, moving shutter a toward nozzle 4. Upon the deformation of bellows 12 and 13, the pressure of the air in them increases. As a result, a part of the air is released through flow-control valve 14 to the atmosphere, and shutter a smoothly returns to its initial position. When the pressure in the system drops, the elements of the regulator operate in the reverse direction.

4094	PRESSURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



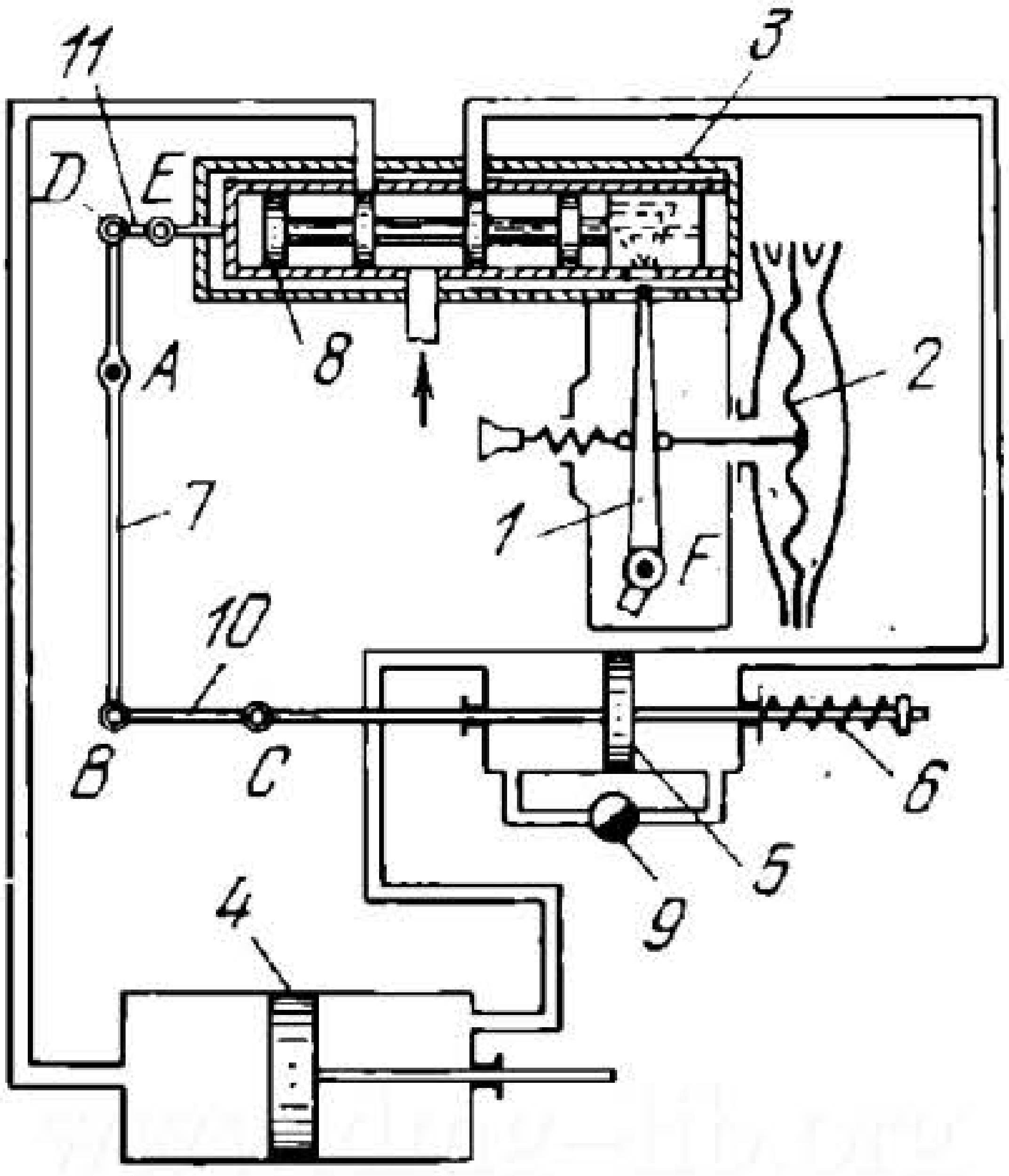
Hand 2, turning about fixed axis A, is linked to Bourdon tube *1*, which is connected to the item whose pressure is to be regulated. Link *16* is connected by turning pairs C and D to hand *2* and to lever *3* which, in turn, is connected by turning pair B to the rod of bellows *13* and carries shutter *a*. When the pressure rises in the item being regulated, hand *2* turns counterclockwise, and shutter *a* is retracted from nozzle *4* to which compressed air is delivered through tube *5* and flow-control valve *6*. Compressed air is also delivered through flow-control valve *9* to the chamber of valve *8* whose ball is linked to bellows *7*. The chamber of bellows *7* is connected to nozzle *4*. The chamber of valve *8* is connected to the atmosphere and to the membrane chamber of servomotor *10*. As shutter *a* is retracted from nozzle *4*, the pressure in bellows *7* drops and the ball of valve *8* is raised, closing off air discharge to the atmosphere. After this, pressure on the membrane of servomotor *10* increases and valve *11* is closed to some extent, reducing the supply of heat-carrying agent to the system. The increase in air pressure is transmitted to feedback bellows *12* with a certain lag owing to the provision of flow-control valve *15* whose clear opening can be regulated. During this lag, the pressure on the membrane of servomotor *10* continues to remain more than it would be with ordinary operation of a feedback bellows, i.e. one without flow-control valve *15*. With this arrangement, regulating valve *11* first greatly reduces the supply of heat-carrying agent, thereby tending to decrease a subsequent deviation of the parameter being regulated and reduce the length of the transient state. Upon deformation of bellows *12* and *13*, the pressure of air in them increases. As a result, a part of the air is released through flow-control valve *14* to the atmosphere, and shutter *a* smoothly returns to its initial position. When the pressure in the system drops, the elements of the regulator operate in the reverse direction.

4095	SPEED REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



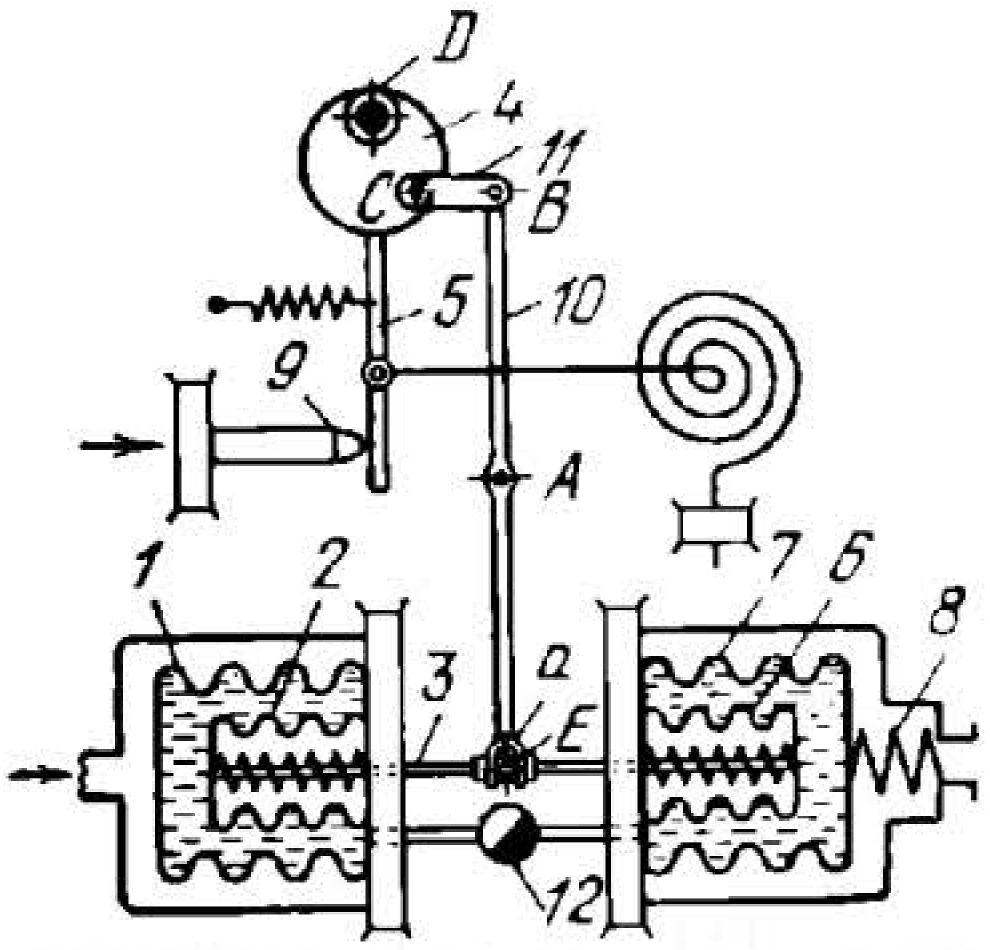
Lever *2* is connected by turning pair *O* to the sleeve of governor *1*. Links *11* and *12* are connected by turning pairs *A*, *F*, *B* and *E* to lever *2* and the piston rod of cataract *7* and to the stem of valve spool *3*. Lever *5* turns about fixed axis *C* and is connected by turning pairs *N* and *K* to links *13* and *14*. Link *13* is connected by turning pair *L* to the lower piston rod of servomotor *6*, and link *14* is connected by turning pair *M* to shutter *4*. When the speed of the item being regulated increases, the balls of centrifugal governor *1* move outward and its sleeve is raised, turning lever *2* about point *A*. This raises spool *3* of the valve, admitting fluid into the lower end of servomotor *6*. The servomotor piston moves upward, lever *5* is turned about axis *C* and shutter *4* moves downward, reducing the supply of the heat-carrying agent to the system. As the piston of servomotor *6* moves upward, it raises the piston of cataract *7*. At this, tie-rod *9* turns lever *10* clockwise about fixed axis *D*, raising the point of suspension of spring *8*. This turns lever *2* about point *O*, shifting valve spool *3* downward. Fluid from the lower end of the cataract cylinder flows through flow-control valve *15* into the upper end. After this, spring *8* will no longer be stretched and point *A* will be located higher than its initial position. For this reason, valve spool *3* returns to its central position only at a speed exceeding the initial value.

FLEXIBLE FEEDBACK MECHANISM IN REGULATORS



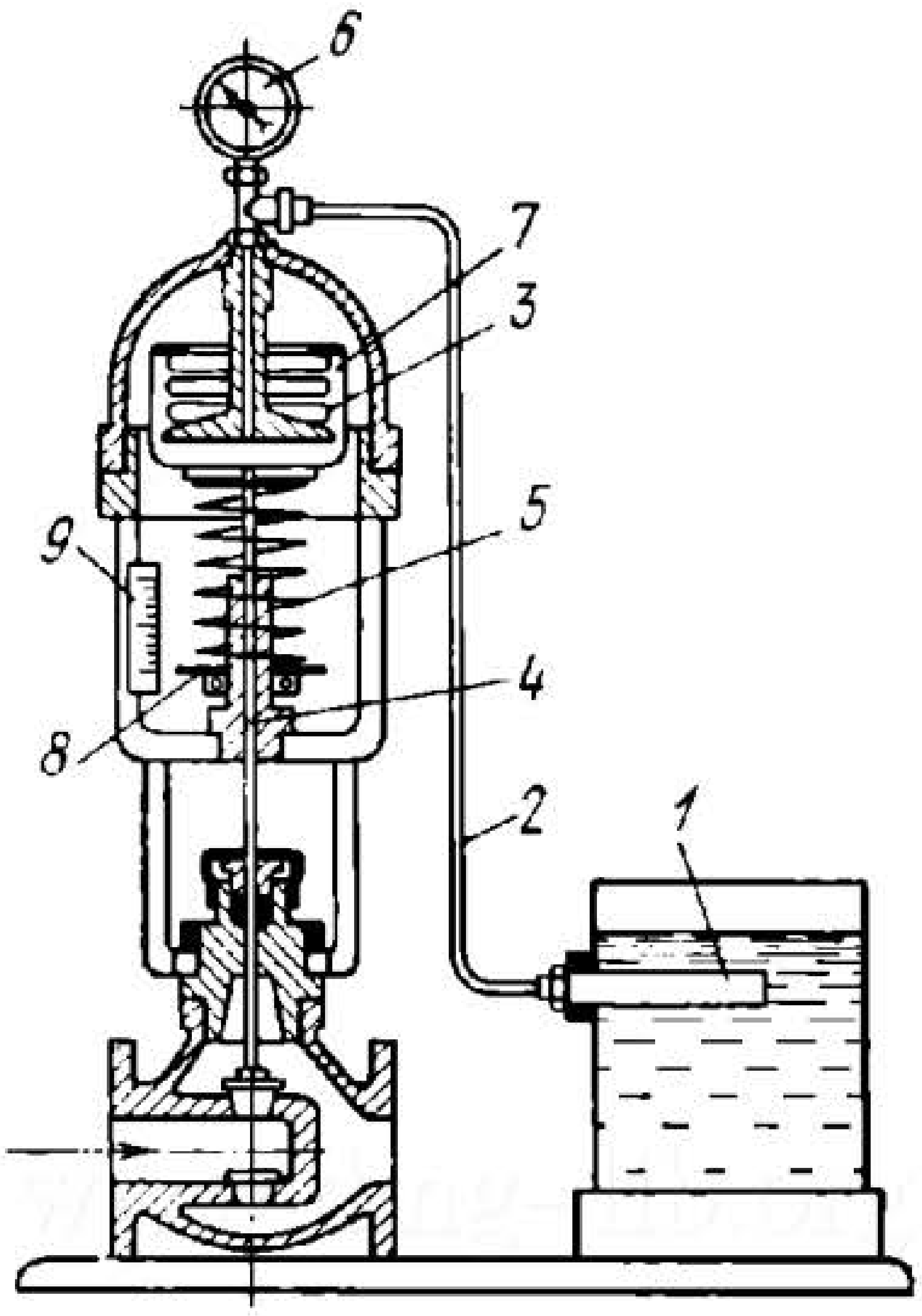
Lever *7* turns about fixed axis *A* and is connected by turning pairs *B* and *D* to links *10* and *11*. Link *10* is connected by turning pair *C* to the rod of piston *5*, and link *11* by turning pair *E* to valve *3*. When jet valve nozzle *1*, turning about fixed axis *F*, is diverted by membrane *2* owing to an increase in pressure on the membrane, the spool of valve *3* is shifted, admitting fluid to move the piston of servomotor *4* and the piston of auxiliary servomotor *5*. This compresses spring *6* and lever *7* shifts sleeve *8*. Then, as the fluid flows from one end of the cylinder of auxiliary servomotor *5* to the other end through flow-control valve *9*, the piston of servomotor *5* moves to the right and lever *7* returns valve sleeve *8* to its initial position. When the pressure drops in the right-hand chamber of membrane *2*, the elements of the regulator operate in the reverse direction.

4097	FLEXIBLE FEEDBACK MECHANISM IN REGULATORS	EHP Rg



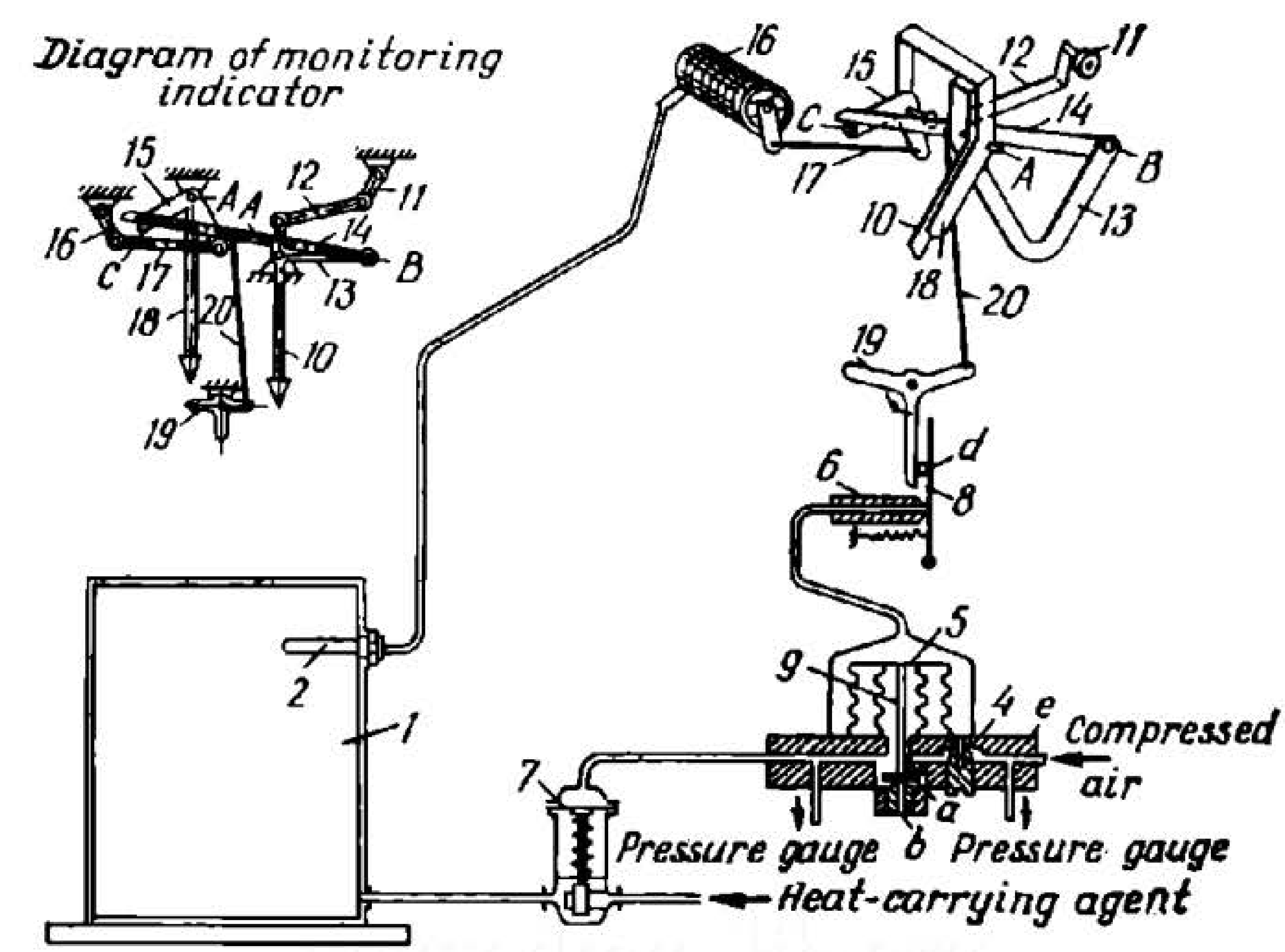
Crank *4*, designed as an eccentric, turns about fixed axis *D*. Link *11* is connected by turning pairs *C* and *B* to crank *4* and to lever *10* which turns about fixed axis *A* and has at its other end fork *a*. Fork *a* engages pin *E* of rod *3*. When the pressure acting on outer bellows *1* increases, inner bellows *2* is compressed, moving rod *3* to the right and turning crank *4* clockwise by means of lever *10* and link *11*. At this; shutter *5*, attached to crank *4*, approaches nozzle *9*. As rod *3* moves to the right, right-hand bellows *6* and *7* are stretched, compressing spring *8*. As the fluid from the space between bellows *6* and *7* flows back through flow-control valve *12* into the space between bellows *1* and *2*, the bellows return to their initial position, as does rod *3*. This returns shutter *5* to its initial position with respect to nozzle *9*. When the pressure acting on outer bellows *1* decreases, the elements of the regulator operate in the reverse direction.

4098	TEMPERATURE REGULATOR MECHANISM	EHP Rg



The vapour pressure thermometer consists of thermal bulb *1*, capillary tube *2* and bellows *3*, housed in airtight box *7*. When the temperature and, consequently, the pressure increase in the vapour pressure thermometer, the force acting on the bellows box also increases, the bellows and spring *5* are compressed, stem *4* of the valve moves downward and closes the valve to some extent, reducing the supply of heat-carrying agent to the system. When the pressure in the system is reduced, spring *5* raises box *7*, stretching the bellows. As a result, the clear opening of the regulating valve increases. The regulator is set to the required temperature by changing the initial compression of the spring. This is done by adjusting washer *8* to the corresponding graduation of scale *9*. Pressure gauge *6* with a temperature scale serves to check the temperature.

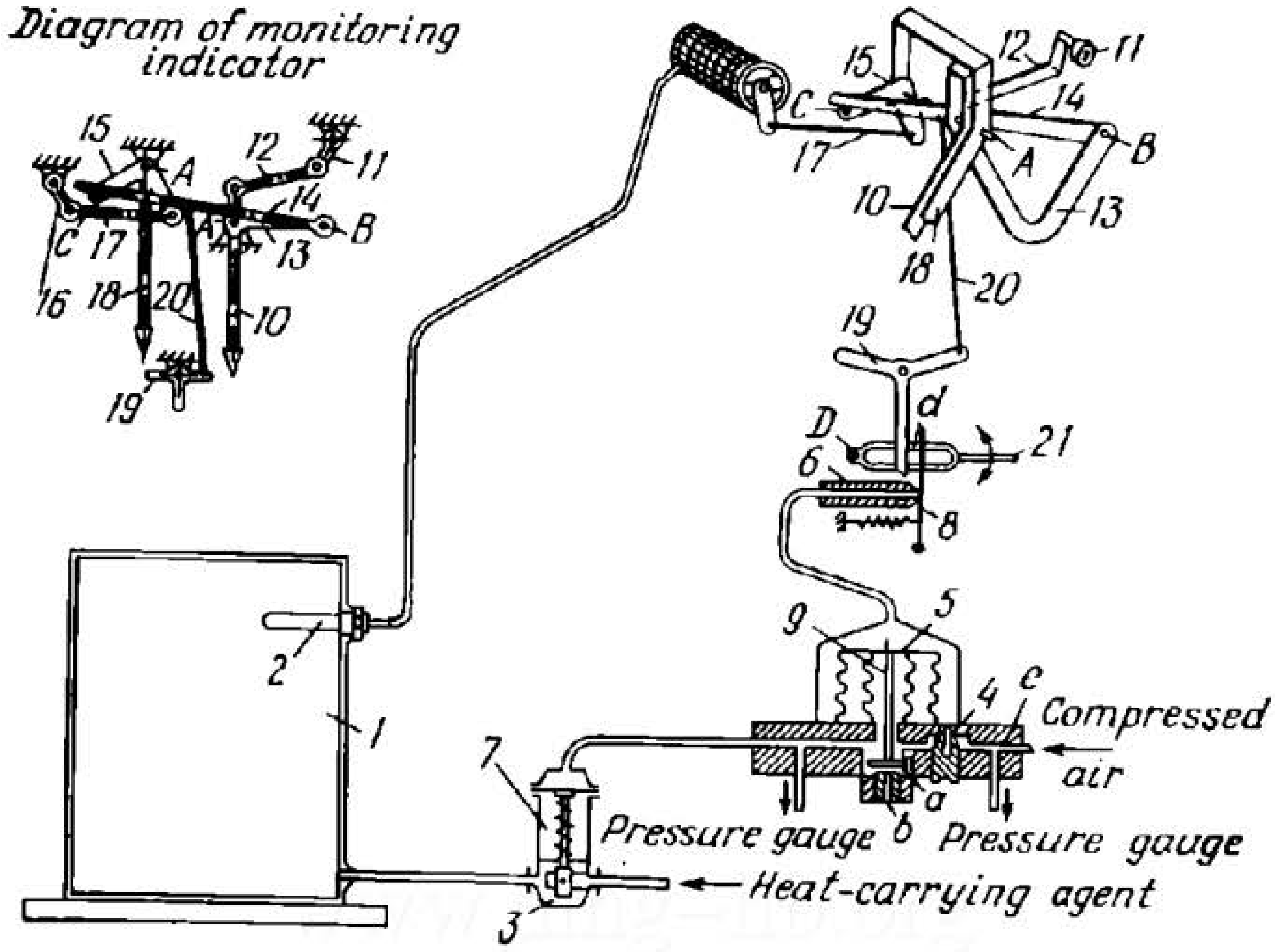
4099	TEMPERATURE REGULATOR MECHANISM	EHP Rg



The temperature in vessel 1 is regulated by varying the supply of heat-carrying agent flowing through regulating valve 3, which is linked to membrane-type servomotor 7. Compressed air is delivered to the system through tube *e* and is divided into two streams. The first passes through pressure reducer 4 into the space above bellows 5 and further to nozzle 6. The second stream passes through orifice *a* to the inner chamber of bellows 5, to the atmosphere through orifice *b*, and to the upper (membrane) chamber of servomotor 7. As shutter 8 is retracted from nozzle 6, the pressure acting on bellows 5 is reduced. At this, valve member 9 moves upward, closing inlet orifice *a* and opening discharge outlet *b*. This reduces the pressure on the servomotor membrane so that its spring closes valve 3 to some extent. When shutter 8 approaches nozzle 6, the bellows are compressed, valve member 9 moves downward, the pressure on the servomotor membrane is increased and valve 3 opens. The required temperature in vessel 1 is set by the monitoring indicator. Through tie-rod 12, handle 11 turns lever 13 about axis *A*, and monitoring hand 10, linked to lever 13, is set to the required temperature. At this, lever 14 turns about pin *C* of lever 15. Upon a change in temperature in vessel 1, hollow helical spring 16 of pressure-spring thermometer 2 either winds up or unwinds to some extent and, through tie-rod 17, lever 15 and pin *C*, turns lever 14 about axis *B*. This turns pen 18, rigidly attached to lever 15. Suspended from

lever *14* is tie-rod *20* whose axis of rotation coincides with the geometric axis of rotation of pen *18* when the pen coincides with monitoring hand *10* (see the diagram of the monitoring indicator). In this position, tie-rod *20*, through lever *19* and pin *d*, provides for light contact between shutter *8* and nozzle *6*. Simultaneous motion of coinciding pen *18* and hand *10* has no effect on the position of shutter *8*. When the temperature drops in vessel *1*, helical spring *16* winds up somewhat and displaces pen *18* to the right of monitoring hand *10*. In turning, lever *14* lowers tie-rod *20* which turns lever *19* clockwise. At this, shutter *8* closes nozzle *6*, pressure on the membrane of servomotor *7* is increased and valve *3* is opened, increasing the supply of heat-carrying agent to the system. The mechanism operates in a similar manner if monitoring hand *10* deviates from pen *18*.

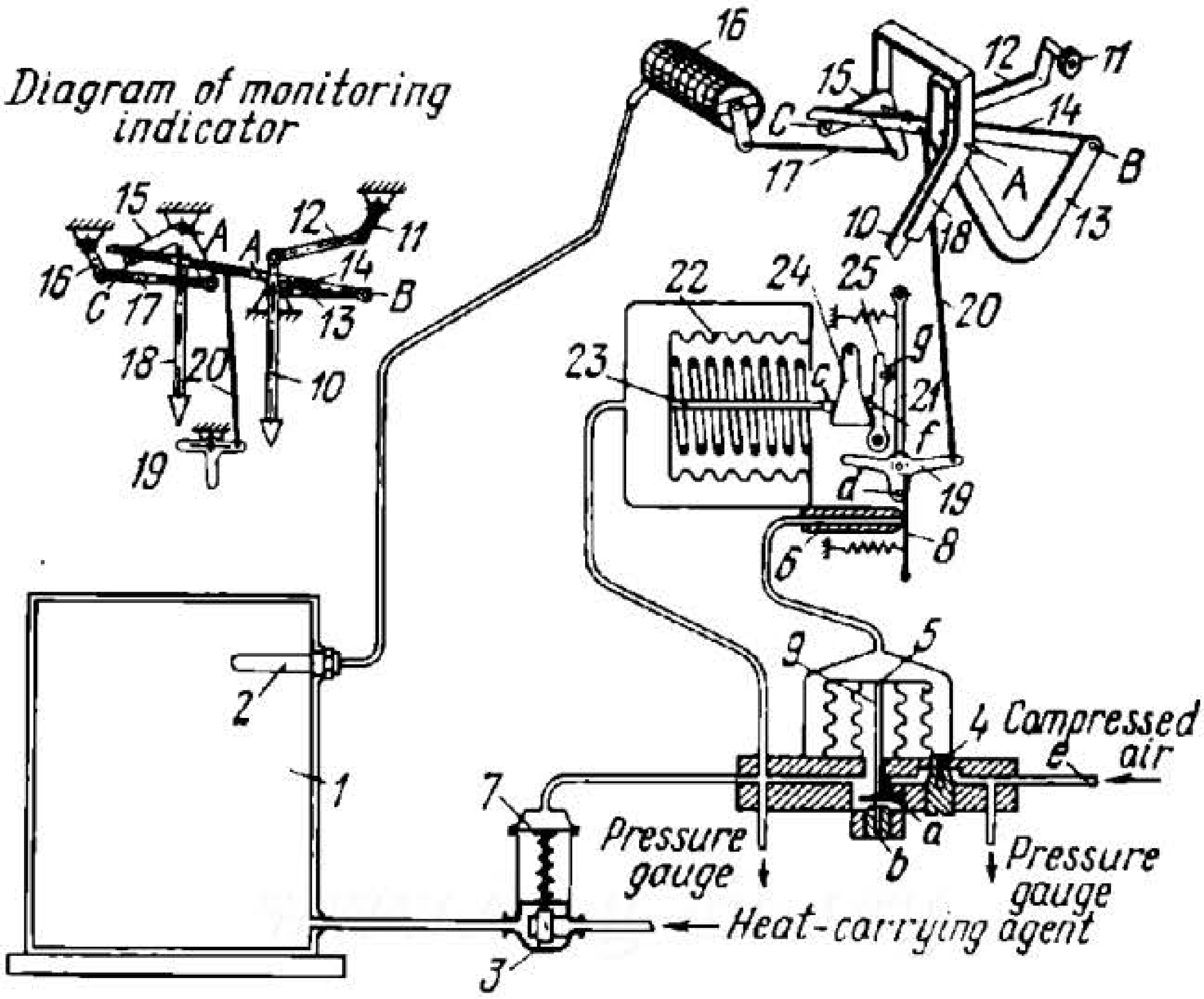
4100	NARROW-RANGE TEMPERATURE REGULATOR MECHANISM	EHP Rg



The temperature in vessel *1* is regulated by varying the supply of heat-carrying agent flowing through regulating valve *3*, which is linked to membrane-type servomotor *7*. Compressed air is delivered to the system through tube *e* and is divided into two streams. The first passes through pressure reducer *4* into the space above bellows *5* and further to nozzle *6*. The second stream passes through orifice *a* to the inner chamber of bellows *5*, to the atmosphere through orifice *b*, and to the upper (membrane) chamber of servomotor *7*. As shutter *8* is retracted from nozzle *6*, the pressure acting on bellows *5* is reduced. At this, valve member *9* moves upward, closing inlet orifice *a* and opening discharge outlet *b*. This reduces the pressure on the servomotor membrane so that its spring closes valve *3* to some extent. When shutter *8* approaches nozzle *6*, the bellows are compressed, valve member *9* moves downward, the pressure on the servomotor membrane is increased and valve *3* opens. The required temperature in vessel *1* is set by the monitoring indicator. Through tie-rod *12*, handle *11* turns lever *13* about axis *A*, and monitoring hand *10*, linked to lever *13*, is set to the required temperature. At this, lever *14* turns about pin *C* of lever *15*. Upon a change in temperature in vessel *1*, hollow helical spring *16* of pressure-spring thermometer *2* either winds up or unwinds to some extent and, through tie-rod *17*, lever *15* and pin *C*, turns lever *14* about axis *B*. This turns pen *18*,

rigidly attached to lever *15*. Suspended from lever *14* is tie-rod *20* whose axis of rotation coincides with the geometric axis of rotation of pen *18* when the pen coincides with monitoring hand *10* (see the diagram of the monitoring indicator). In this position, tie-rod *20*, through lever *19* and pin *d*, provides for light contact between shutter *8* and nozzle *6*. Simultaneous motion of coinciding pen *18* and hand *10* has no effect on the position of shutter *8*. When the temperature drops in vessel *1*, helical spring *16* winds up somewhat and displaces pen *18* to the right of monitoring hand *10*. In turning, lever *14* lowers tie-rod *20* which turns lever *19* clockwise. At this, shutter *8* closes nozzle *6*, pressure on the membrane of servomotor *7* is increased and valve *3* is opened, increasing the supply of heat-carrying agent to the system. The change in pressure acting on the membrane of servomotor *7* depends both on the amount of deviation of pen *18* from monitoring hand *10* and on the position of pin *d*, which is set by means of slotted lever *21*, turning about axis *D*. The position of lever *19* can be changed by moving its axis with a special mechanism (not shown).

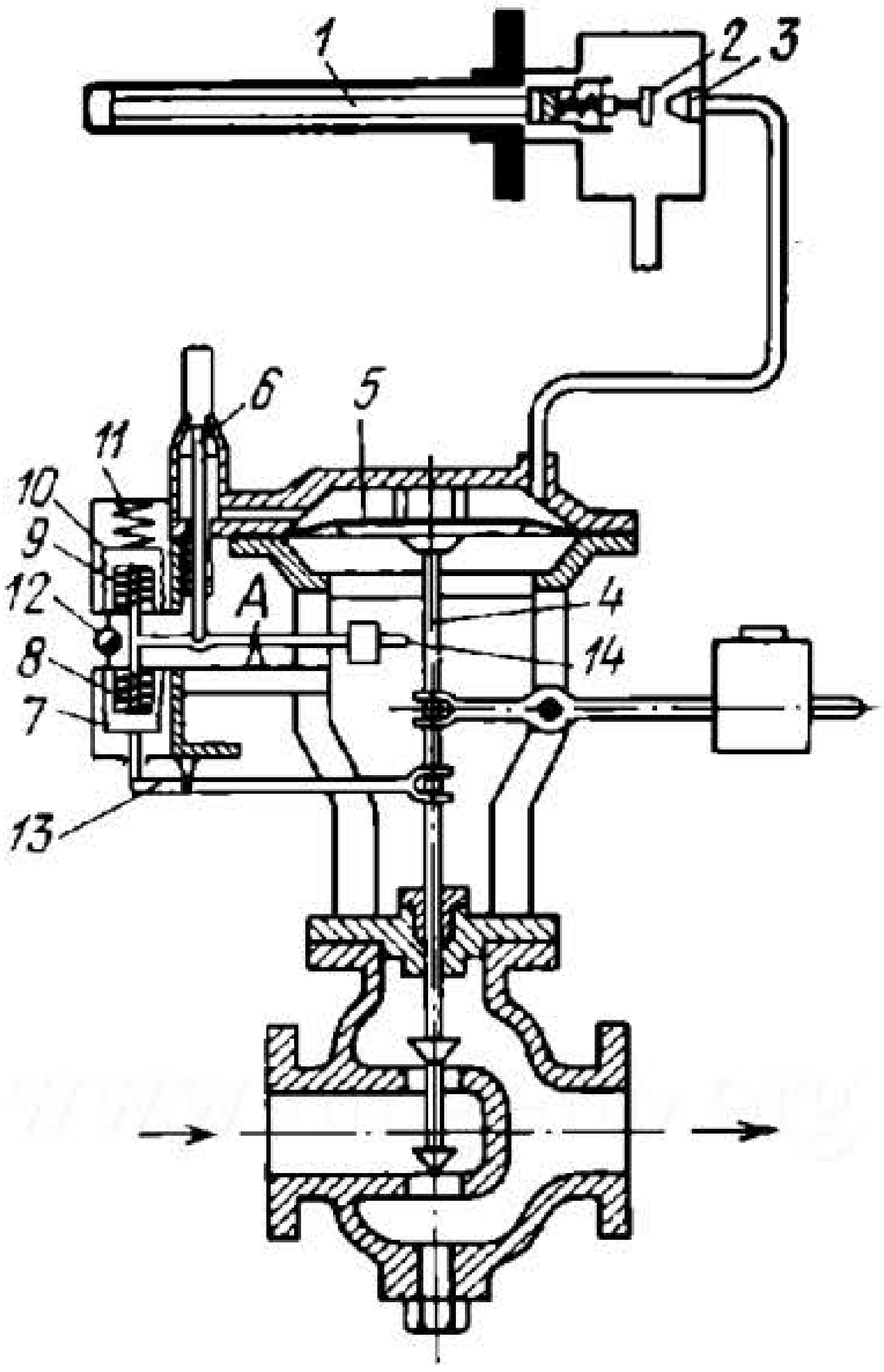
4101	TEMPERATURE REGULATOR MECHANISM WITH DIRECT FEEDBACK	EHP Rg



The temperature in vessel *1* is regulated by varying the supply of heat-carrying agent flowing through regulating valve *3*, which is linked to membrane-type servomotor *7*. Compressed air is delivered to the system through tube *e* and is divided into two streams. The first passes through pressure reducer *4* into the space above bellows *5* and further to nozzle *6*. The second stream passes through orifice *a* to the inner chamber of bellows *5*, to the atmosphere through orifice *b* and to the upper (membrane) chamber of servomotor *7*. As shutter *8* is retracted from nozzle *6*, the pressure acting on bellows *5* is reduced. At this, valve member *9* moves upward, closing inlet orifice *a* and opening discharge outlet *b*. This reduces the pressure on the servomotor membrane so that its spring closes valve *3* to some extent. When shutter *8* approaches nozzle *6*, the bellows are compressed, valve member *9* moves downward, the pressure on the servomotor membrane is increased and valve *3* opens. The required temperature in vessel *1* is set by the monitoring indicator. Through tie-rod *12*, handle *11* turns lever *13* about axis *A*, and monitoring hand *10*, linked to lever *13*, is set to the required temperature. At this, lever *14* turns about pin *C* of lever *15*. Upon a change in temperature in vessel *1*, hollow helical spring *16* of pressure-spring thermometer 2 either winds up or unwinds to some extent and, through tie-rod *17*, lever *15* and pin *C*, turns lever *14* about axis *B*. This turns pen *18*, rigidly attached to lever *15*. Suspend-

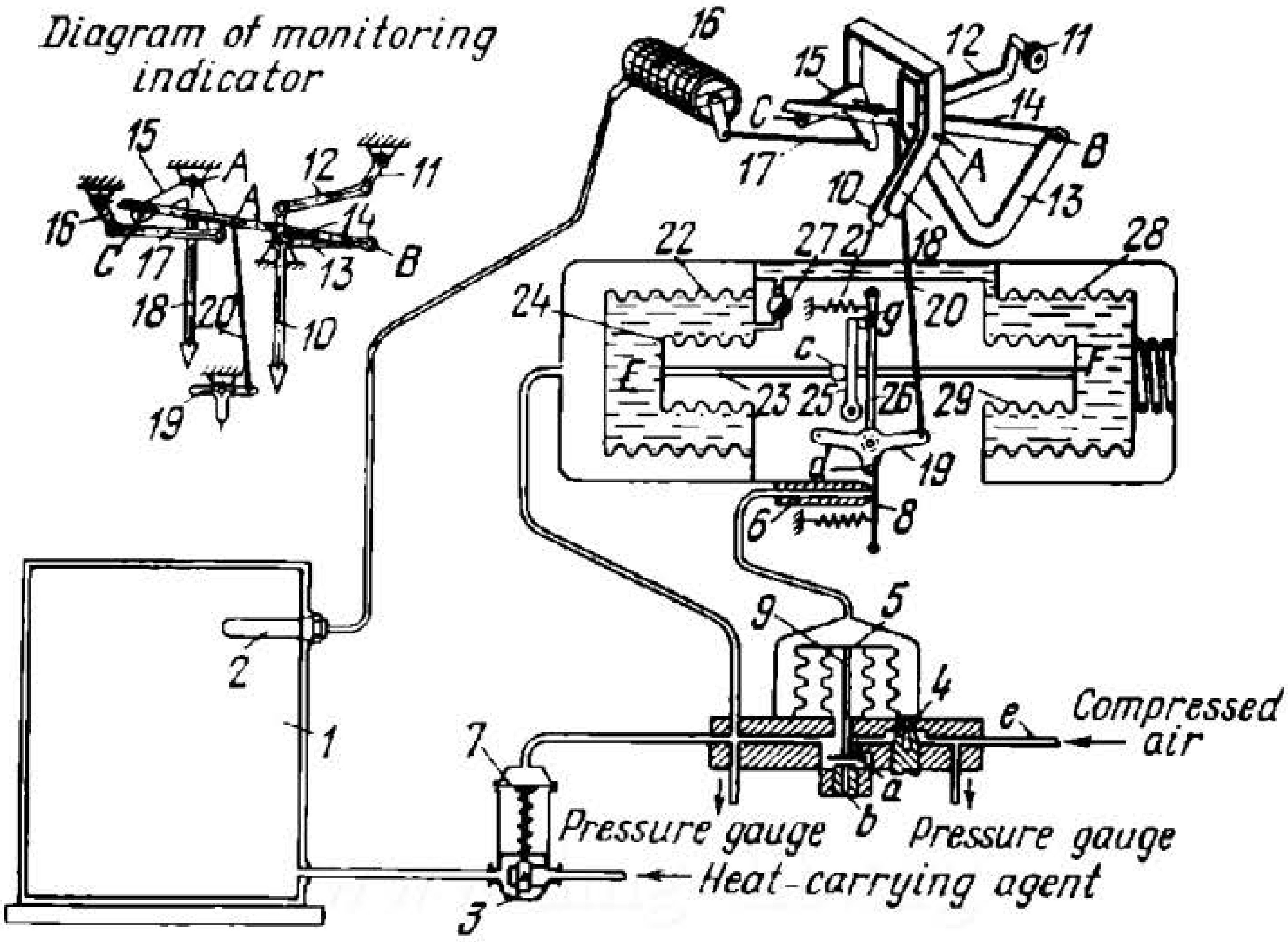
·d from lever *14* is tie-rod *20* whose axis of rotation coincides with the geometric axis of rotation of pen *18* when the pen coincides with monitoring hand *10* (see the diagram of the monitoring indicator). In this position, tie-rod *20*, through lever *19* and pin *d*, provides for light contact between shutter *8* and nozzle *6*. Simultaneous motion of coinciding pen *18* and hand *10* has no effect on the position of shutter *8*. When the temperature drops in vessel *1*, helical spring *16* winds up somewhat and displaces pen *18* to the right of monitoring hand *10*. In turning, lever *14* lowers tie-rod *20* which turns lever *19* clockwise. At this, shutter *8* closes nozzle *6*, pressure on the membrane of servomotor *7* is increased and valve *3* is opened, increasing the supply of heat-carrying agent to the system. The same pressure acts on bellows *22*, moving its stem *23* with rigidly attached pin *c* to the right. This also displaces lever *24* and pin *f* of lever *25*. By means of pin *g*, lever *25* turns lever *21* which carries lever *19*. Lever *19* retracts shutter *8* from nozzle *6*. Thus, the shutter is retracted from the nozzle almost the same amount as it approached the nozzle by the action of helical spring *16*. The position of pin *g* and, consequently, the range of regulation are varied by a special mechanism (not shown).

4102	TEMPERATURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



The working fluid is delivered to the system through flow-control valve *6* to nozzle *3*. When the temperature of the item being regulated increases, thermal bulb *1* displaces shutter *2* with respect to nozzle *3* to the right, increasing the pressure on membrane *5*. This lowers rod *4*, rigidly attached to the membrane, reducing the supply of heat-carrying agent to the system and thereby reducing the temperature of the item being regulated. As rod *4* moves downward, it turns lever *13*, compressing bellows *7* and *8*, and stretching bellows *9* and *10*. The last two bellows compress spring *11*. At this, lever *14* is turned about fixed axis *A*, closing flow-control valve *6* to some extent with a needle member and reducing the delivery of the working fluid to the system. This reduces the pressure on membrane *5*. Then, as the fluid in the upper bellows flows back to the lower bellows through flow-control valve *12*, the bellows return to their middle position as does flow-control valve *6*.

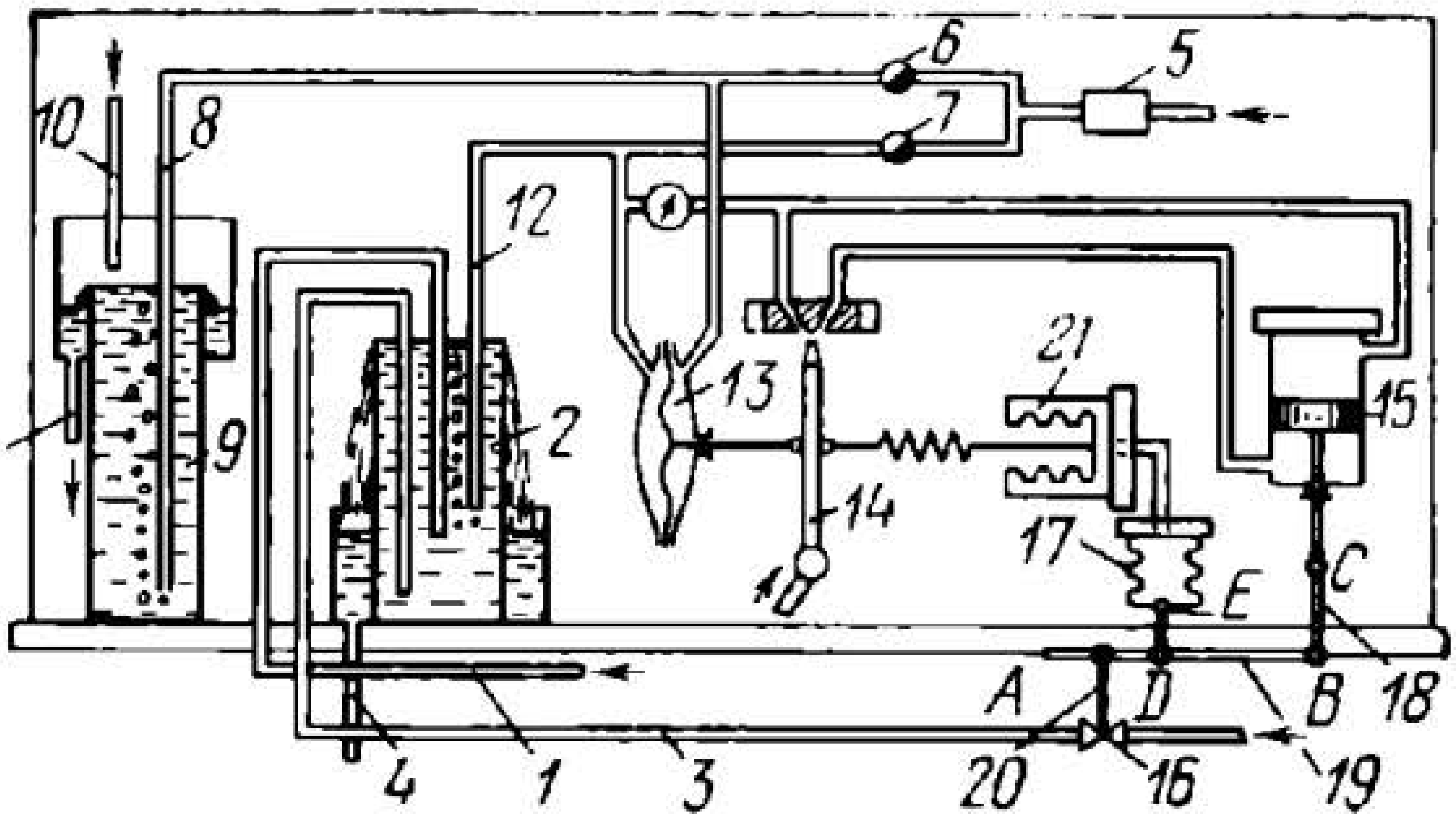
4103	TEMPERATURE REGULATOR MECHANISM WITH FLEXIBLE FEEDBACK	EHP Rg



The temperature in vessel *1* is regulated by varying the supply of heat-carrying agent flowing through regulating valve *3*, which is linked to membrane-type servomotor *7*. Compressed air is delivered to the system through tube *e* and is divided into two streams. The first passes through pressure reducer *4* into the space above bellows *5* and further to nozzle *6*. The second stream passes through orifice *a* to the inner chamber of bellows *5*, to the atmosphere through orifice *b* and to the upper (membrane) chamber of servomotor *7*. As shutter *8* is retracted from nozzle *6*, the pressure acting on bellows *5* is reduced. At this, valve member *9* moves upward, closing orifice *a* and opening discharge outlet *b*. This reduces the pressure on the servomotor membrane so that its spring closes valve *3* to some extent. When shutter *8* approaches nozzle *6*, the bellows are compressed, valve member *9* moves downward, the pressure on the servomotor membrane is increased and valve *3* opens. The required temperature in vessel *1* is set by the monitoring indicator. Through tie-rod *12*, handle *11* turns lever *13* about axis *A*, and monitoring hand *10*, linked to lever *13*, is set to the required temperature. At this, lever *14* turns about pin *C* of lever *15*. Upon a change in temperature in vessel *1*, hollow helical spring *16* of pressure-spring thermometer *2* either winds up or unwinds to some extent and, through tie-rod *17*, lever *15* and pin *C*, turns lever *14* about axis *B*. This turns pen *18*,

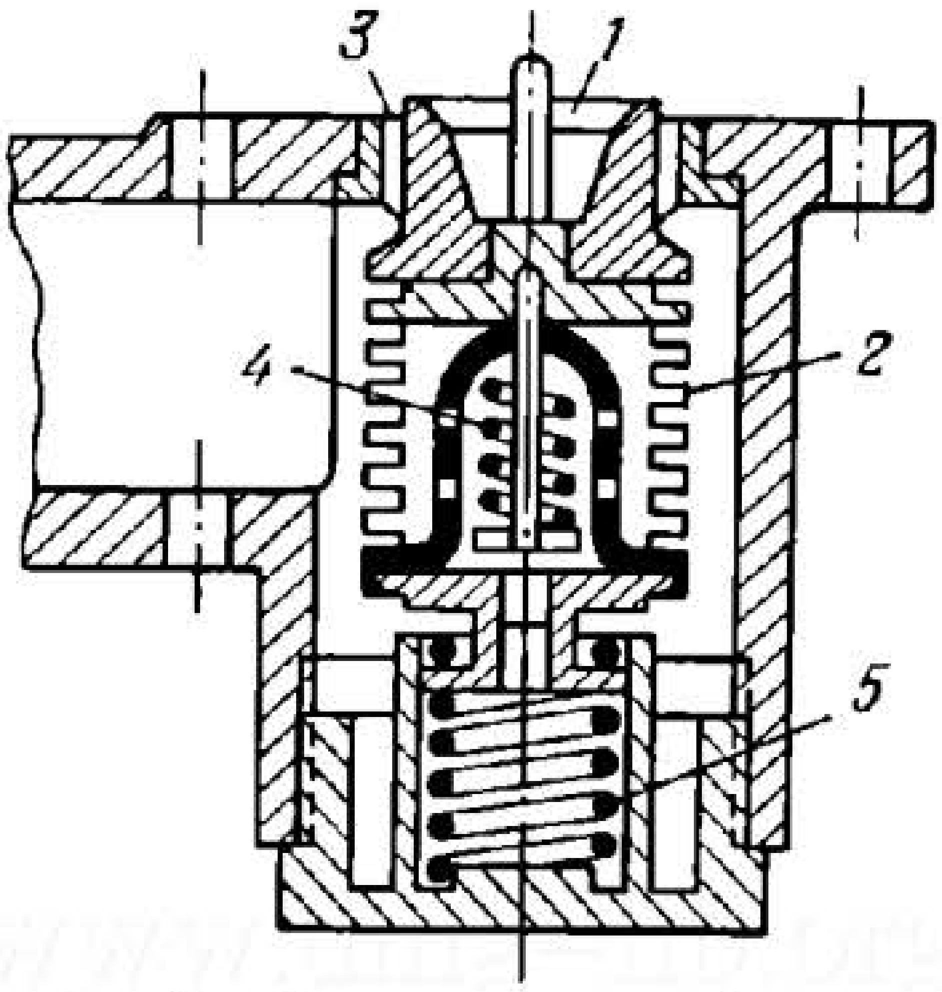
rigidly attached to lever *15*. Suspended from lever *14* is tie-rod *20* whose axis of rotation coincides with the geometric axis of rotation of pen *18* when the pen coincides with monitoring hand *10* (see the diagram of the monitoring indicator). In this position, tie-rod *20*, through lever *19* and pin *d*, provides for light contact between shutter *8* and nozzle *6*. Simultaneous motion of coinciding pen *18* and hand *10* has no effect on the position of shutter *8*. When the temperature drops in vessel *1*, helical spring *16* winds up somewhat and displaces pen *18* to the right of monitoring hand *10*. In turning, lever *14* lowers tie-rod *20* which turns lever *19* clockwise. At this, shutter *8* closes nozzle *6*, pressure on the membrane of servomotor *7* is increased and valve *3* is opened, increasing the supply of heat-carrying agent to the system. The same pressure acts on bellows *22* and, through the fluid, on bellows *24*. As the bellows is compressed, stem *23* with rigidly attached pin *c* moves to the right. This turns lever *25* and, through pin *g*, lever *26* which carries lever *19*. Lever *19* retracts shutter *8* from nozzle *6*. Then, as the fluid flows back from space *F* (between bellows *28* and *29*) through flow-control valve *27* to space *E* (between bellows *22* and *24*), stem *23* moves to the left. Lever *26* is turned clockwise by spring *21*, moving lever *19* which carries pin *d*. At this, shutter *8* approaches nozzle *6* with a velocity that depends on the velocity of flow of fluid from space *F* to space *E*, or, what is the same, on the difference in pressure of the fluid in these spaces.

4104	SOLUTION DENSITY REGULATOR MECHANISM	EHP Rg



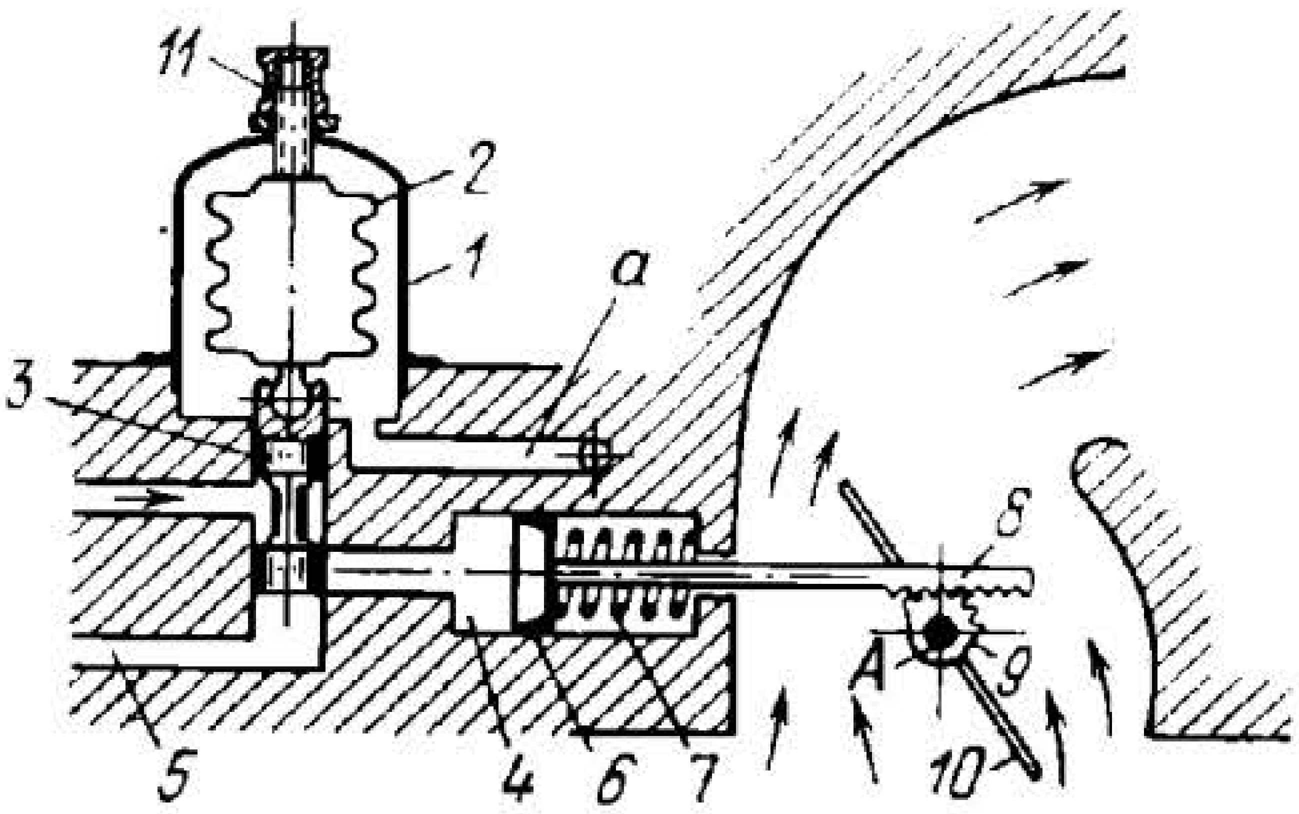
Link *19* turns about fixed axis *A* and is connected by turning pairs *B* and *D* to link *18* of the piston rod in servomotor *15*, and to bellows *17*. The concentrated solution is delivered through pipe *1* to mixer *2*, to which water is also delivered through pipe *3*. As a result of mixing, a solution of the required density is obtained and discharged through pipe *4*. Compressed air is delivered to the system through pressure reducer *5* and flow-control valves *6* and *7*. Air from flow-control valve *6* flows through pipe *8* whose end is immersed to a definite depth in vessel *9* which is filled with water. Water is delivered to the vessel through pipe *10* and drained through pipe *11*. Air from flow-control valve *7* flows into mixer *2* through pipe *12* whose end is immersed to a definite depth. Air from pipes *8* and *12* is released to the atmosphere, bubbling through the layers of liquid. Depending upon the density of the liquid, the resistance to the escape of air varies. In vessel *9* it is constant, while in mixer *2* it varies with the density of the solution. The difference in resistance to air escape establishes a pressure difference in pipes *8* and *12* which acts on membrane *13*, linked to jet valve nozzle *14*. A change in the density of the solution leads to a change in the pressure difference acting on membrane *13*. As a result, nozzle *14* is diverted and, by means of servomotor *15*, operates regulating valve *16* in the necessary direction. Valve *16* is linked to jet valve nozzle *14* through feedback device *21*.

4105	THERMOSTAT MECHANISM WITH ELASTIC LINKS	EHP Rg



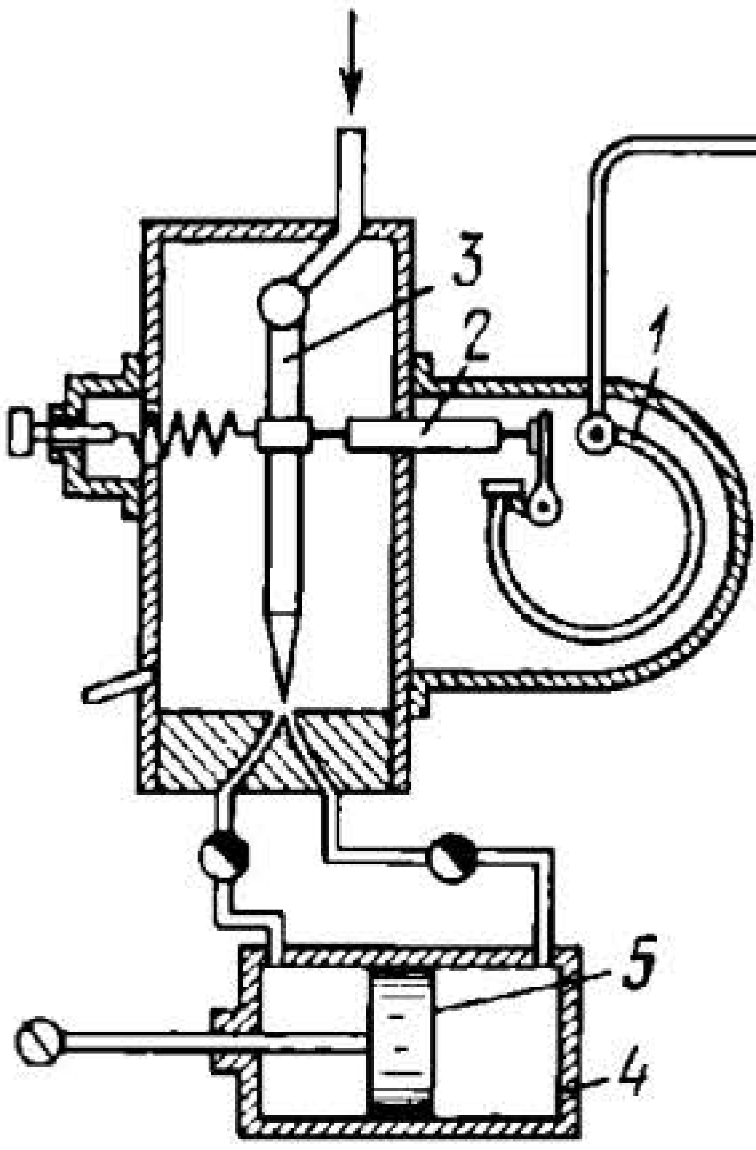
Upon an increase in the temperature of the low-boiling liquid filling bellows *2*, valve member *1*, linked to bellows *2*, moves upward and reduces the clear opening *3*. When the liquid cools, valve member *1* is returned to its initial position by spring *4*. Spring *5* serves to by-pass the liquid upon an increase in pressure in the system.

CARBURETTOR OUTPUT AIR PRESSURE REGULATOR MECHANISM



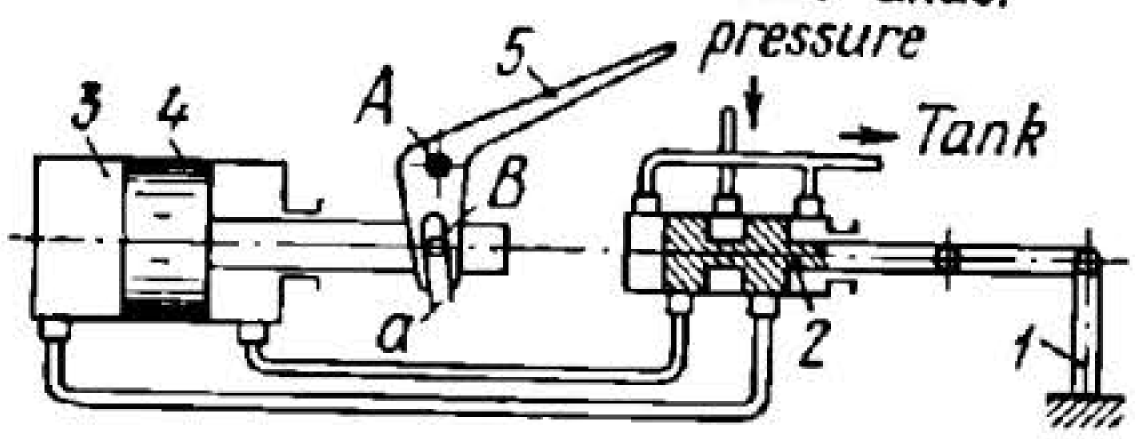
Suspended in housing *1* is bellows *2* filled with air. The space in housing *1* is connected through passage *a* to a high-pressure chamber. Linked to bellows *2* is valve spool *3*. When the pressure in housing *1* exceeds the design value, bellows *2* is compressed and spool *3* is shifted upward. This connects cylinder *4* to channel *5* which leads to the low-pressure mains and the crankcase. Then piston *6* is moved to the left by spring *7* and gear rack *8*, attached to piston *6* and meshing with segment gear *9*, turns the gear about fixed axis *A*. Throttle valve *10*, rigidly attached to gear *9*, turns and reduces the air pressure at the carburettor output. When the air pressure drops in housing *1*, bellows *2* stretches and shifts valve spool *3* downward. At this, the left end of cylinder *4* is connected to the high-pressure fluid mains. The fluid moves piston *6* to the right, compressing spring *7* and turning throttle valve *10* in the direction of a larger opening, thereby increasing the air pressure at the carburettor output. The required pressure at the carburettor output is set by adjusting nut *11*.

4107	PRESSURE REGULATOR MECHANISM	EHP Rg



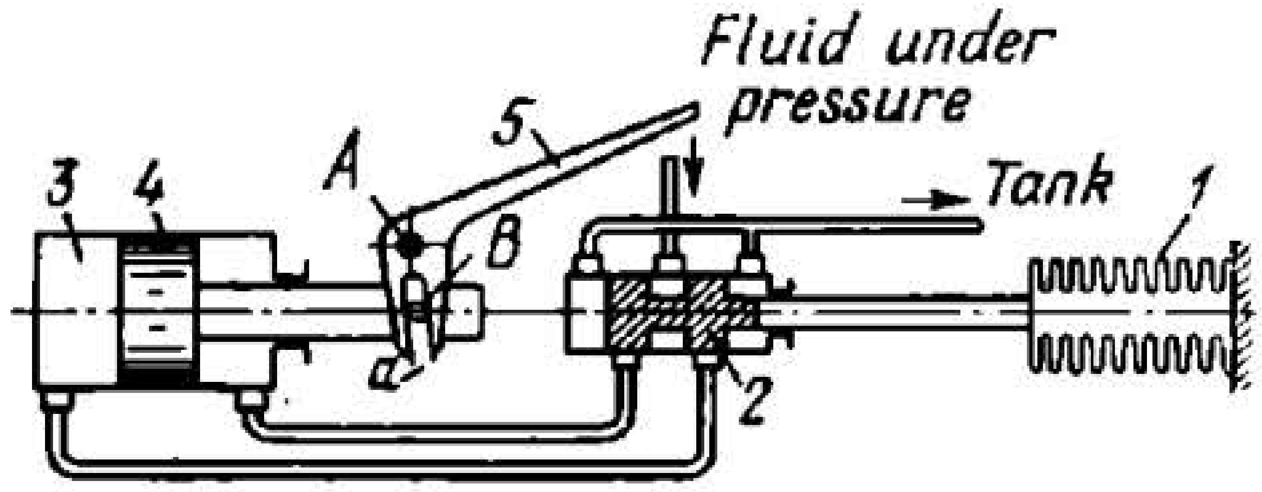
Upon a change in pressure in Bourdon tube *1*, the motion of its free end is transmitted by pin *2* to jet valve nozzle *3*. Nozzle *3* is diverted and fluid, delivered under pressure to the nozzle, is directed through one of the channels to one or the other end of the cylinder of servomotor *4*. As the fluid moves piston *5*, its rod actuates the regulating member that restores the required pressure in the space connected to Bourdon tube *1*.

4108	RADIATOR VENTILATION REGULATOR MECHANISM FOR AN AIRCRAFT ENGINE	EHP Rg



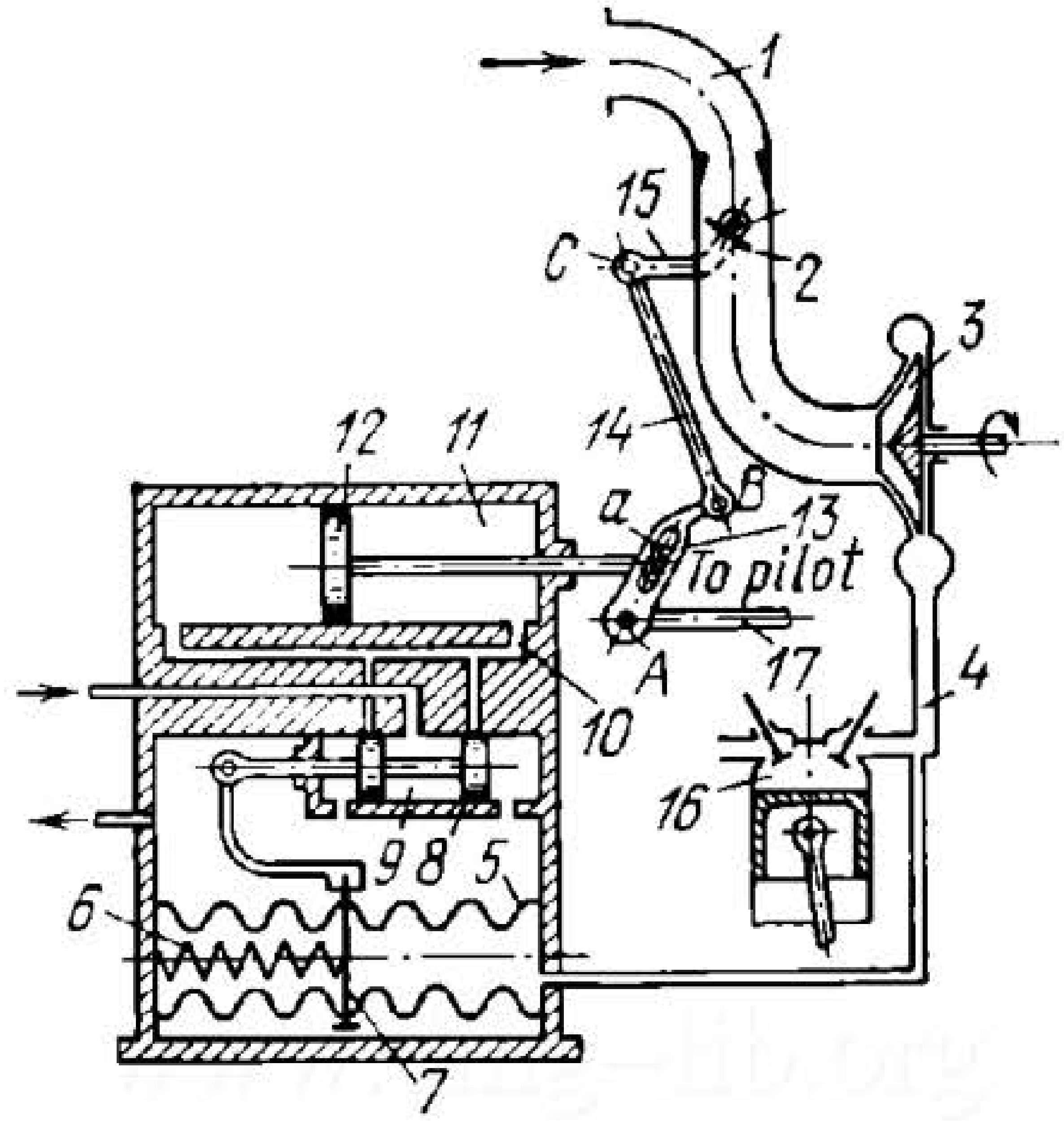
Upon a change in temperature of the medium being regulated, in which bimetallic element *1* is placed, the element actuates the stem of valve spool *2*. At this, fluid, delivered under pressure to the valve, is directed to one of the ends of cylinder *3* and moves piston *4*. As the piston moves, radiator flap *5*, turning about fixed axis *A* and having fork *a* that engages pin *B* of the piston rod, turns and changes the amount of air admitted to the radiator.

4109	RADIATOR VENTILATION REGULATOR MECHANISM FOR AN AIRCRAFT ENGINE	EHP Rg



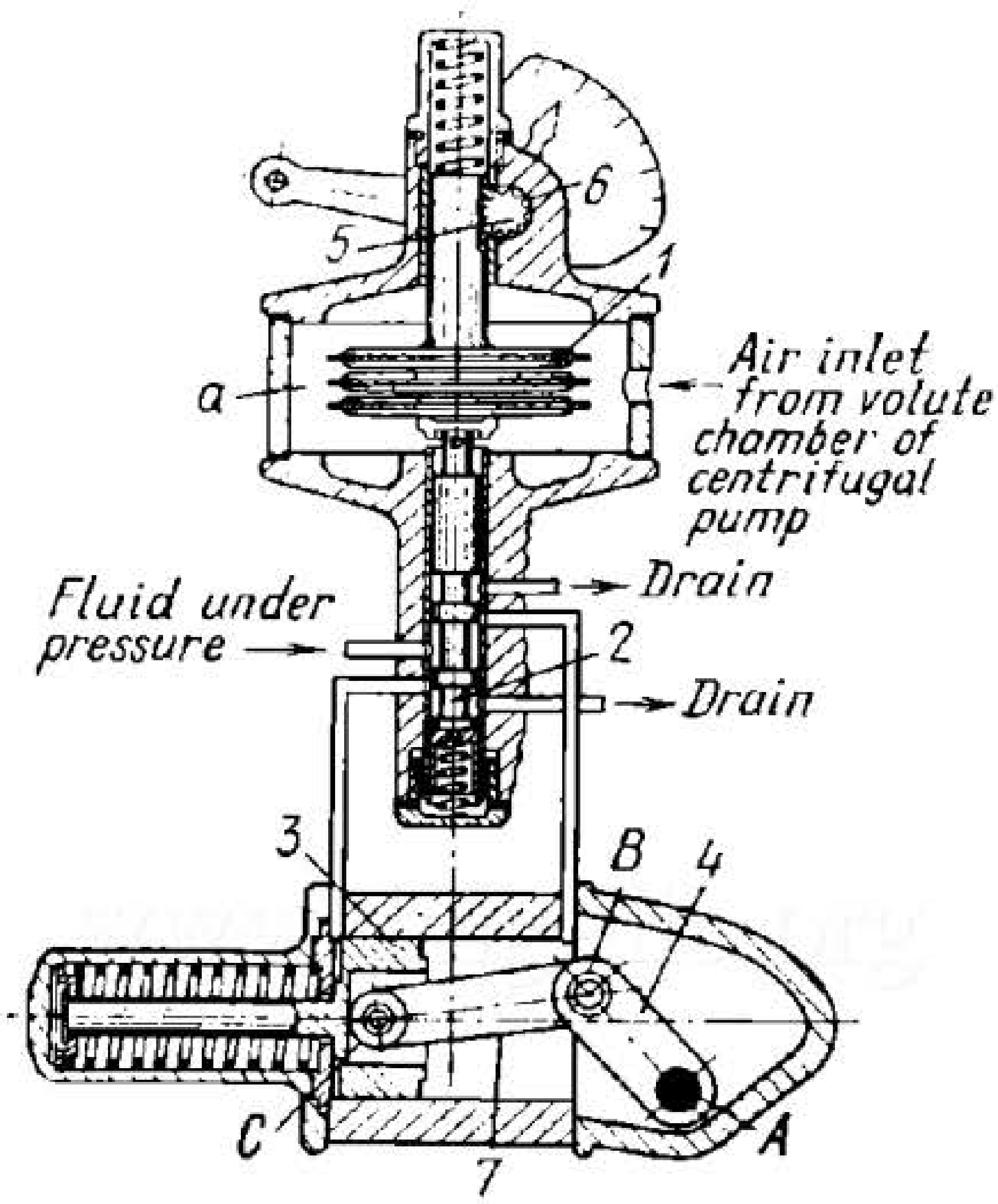
Upon a change in temperature of the medium being regulated, in which bellows *1* is placed, the bellows, filled with a liquid, is deformed by the change in volume of the liquid. This actuates the stem of valve spool *2*. At this, fluid, delivered under pressure to the valve, is directed to one of the ends of cylinder *3* and moves piston *4*. As the piston moves, radiator flap *5*, turning about fixed axis *A* and having fork *a* that engages pin *B* of the piston rod, turns and changes the amount of air admitted to the radiator.

4110	LINK-GEAR MECHANISM FOR AUTOMATIC AIR PRESSURE REGULATION	EHP Rg



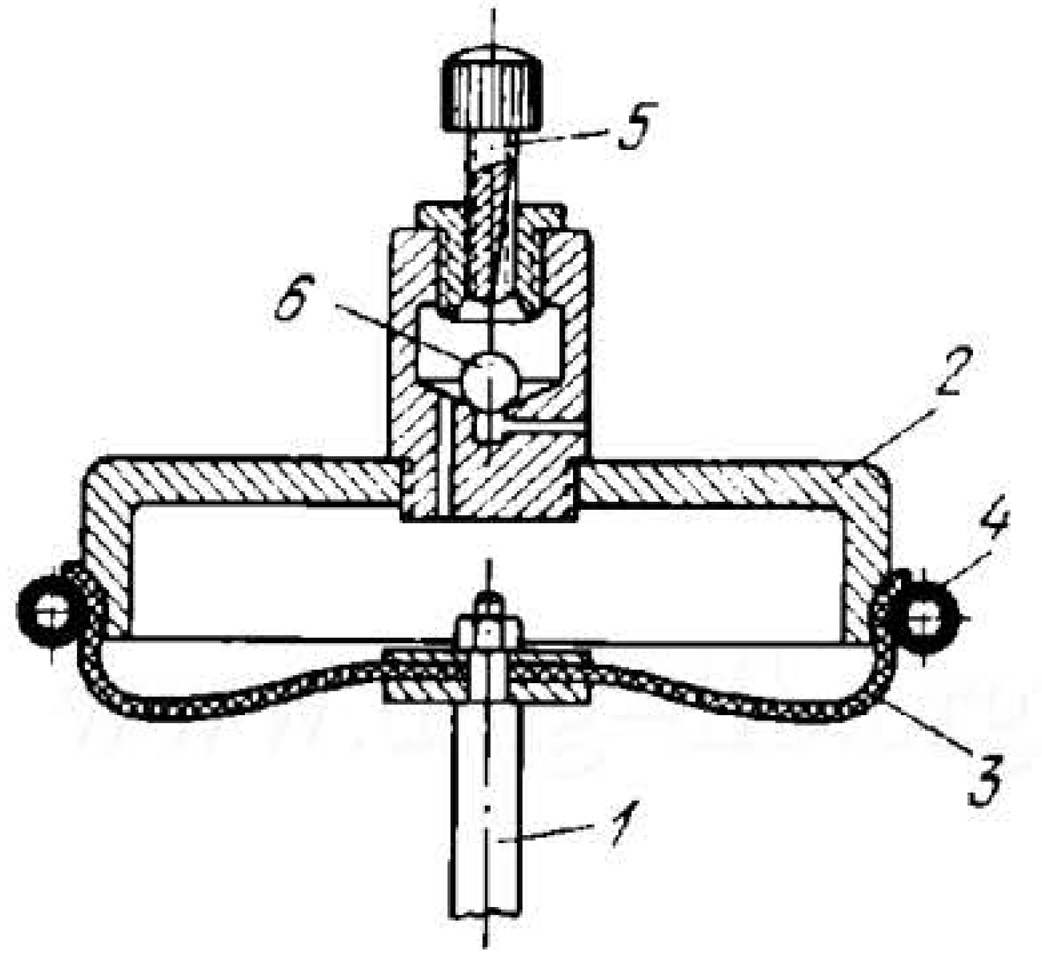
Upon a drop in pressure in suction pipe *1*, the pressure drops in pipeline *4* of supercharger *3* and in bellows *5*. Spring *6* moves common bottom 7 of the bellows to the right, shifting valve spool *8*, linked to bottom 7, also to the right. Fluid, delivered under pressure to internal groove *9* of the valve, is directed through channel *10* to the right end *11* of the servomotor, moving piston *12* to the left. Pin *a*, mounted at the end of the rod of piston *12*, turns rocker arm *13* about fixed axis *A*. Motion is transmitted further through connecting rod *14*, connected by turning pairs *B* and *C* to arm *13* and rocker arm *15*, to throttle valve *2*. Throttle valve *2* turns about a fixed axis and is rigidly attached to rocker arm *15*. This increases the amount of air admitted to supercharger *3* and, consequently, to cylinder *16* of the aircraft engine. When the pressure increases in suction pipe *1*, the elements of the regulator operate in the reverse direction. The initial amount of air admitted to the supercharger is regulated by moving joint *A* with tie-rod *17*.

4111	LEVER MECHANISM OF AN AIRCRAFT ENGINE SUPER-CHARGE REGULATOR	EHP Rg



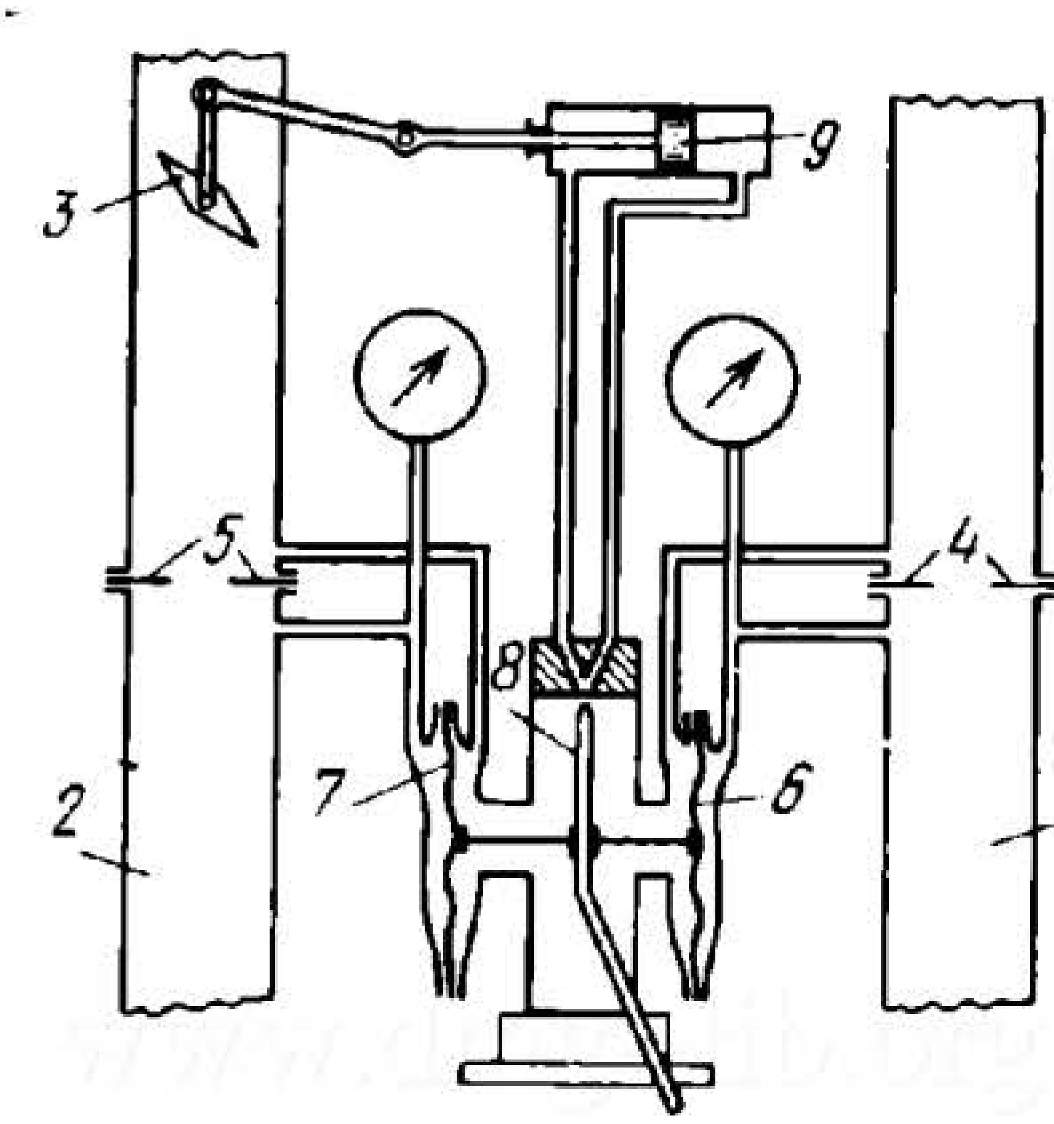
Connecting rod *7* is connected by turning pairs *C* and *B* to piston *3* of the power cylinder and to lever *4*, linked to the flap and turning about fixed axis *A*. Upon a change in the pressure of the air at the supercharger output, which is connected to chamber *a*, the pressure of the liquid in bellows *1* is changed, leading to deformation of the bellows and the shifting of valve spool *2*. At this, fluid delivered to the valve is directed to one of the ends of the power cylinder, moving piston *3*. Fluid from the exhaust end of the cylinder is drained through the valve to the tank. Turning, lever *4* changes the position of the flap at the supercharger input, thereby maintaining constant pressure at the supercharger output. The regulator is set to a definite pressure by turning pinion *6* which meshes with rack *5* of the rod of bellows *1*.

4112	MEMBRANE-TYPE REGULATOR MECHANISM	EHP Rg



When piston rod *1* moves upward, compressed air is released from box *2* through a slit regulated by screw *5*. Box *2* is closed by leather membrane *3*, secured to the box by helical spring *4* whose ends are joined to form a ring. When rod *1* moves downward, air can be drawn in both through the slit and through ball valve 6.

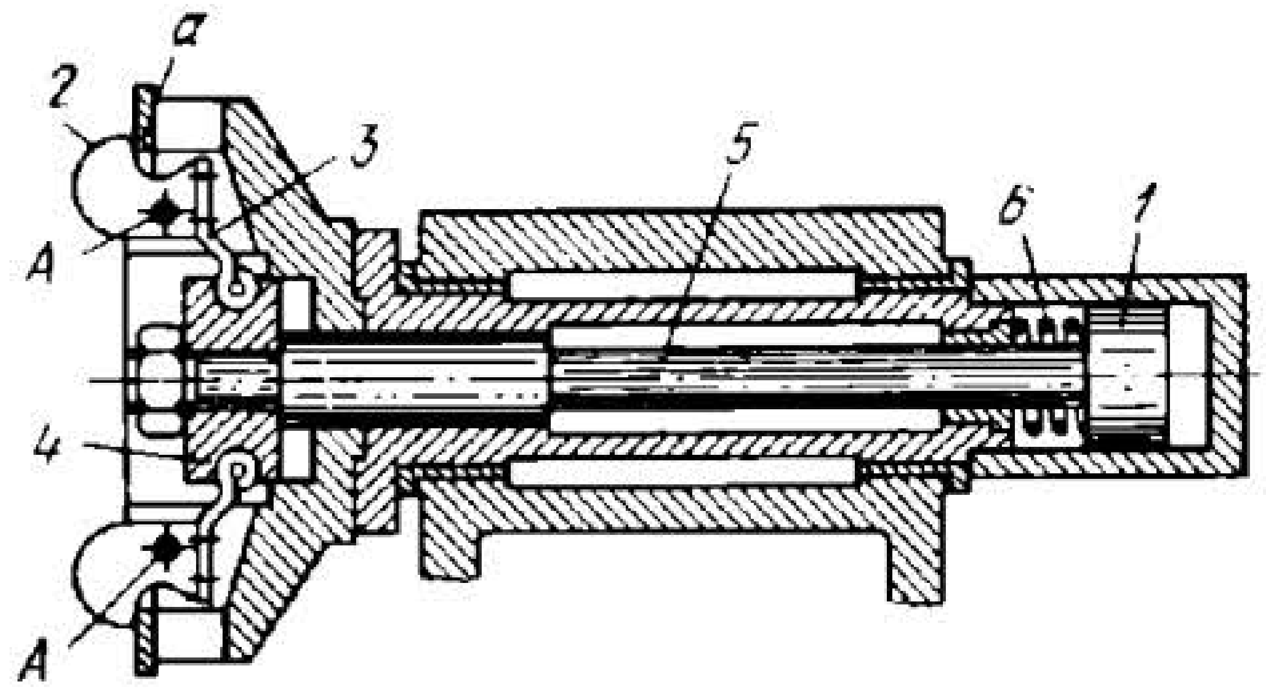
4113	MECHANISM FOR REGULATING THE RATIO OF GAS DELIVERED BY TWO PIPELINES	EHP Rg



One gas flows in pipeline *1* and another gas in pipeline *2*. The amount flowing in pipeline *2* is to be automatically maintained proportional to the flow rate in pipeline *1*. Elastic measuring diaphragms *4* and *5* are mounted in pipelines *1* and *2*. The pulse tubes of the diaphragms are connected to the corresponding membranes *6* and *7* of the regulator. If the forces developed by the membranes are equal, jet valve nozzle *8* will be in the central position. If the gas flow along pipeline *2* decreases, nozzle *8* is diverted to the left. The pressure of the fluid at the left side of piston *9* increases and it moves to the right, opening throttle valve *3* until the previous ratio is restored between the rates of flow of the two gases.

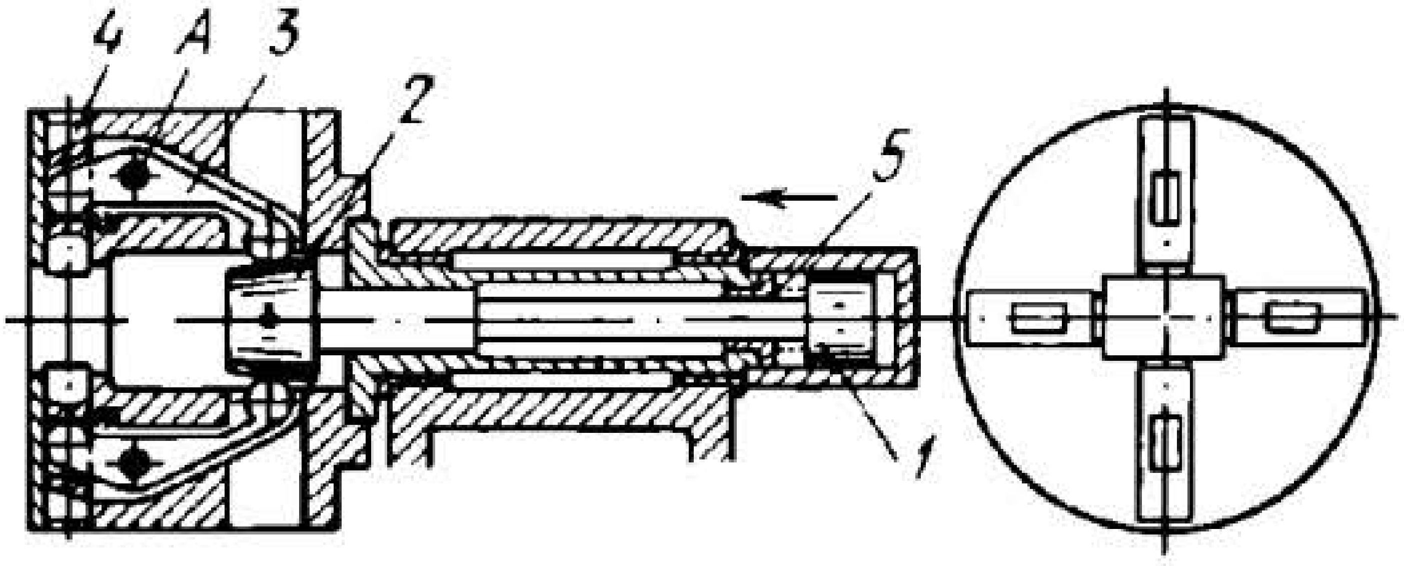
4. GRIPPING, CLAMPING AND EXPANDING MECHANISMS (4114 and 4115)

4114	HYDRAULIC CLAMPING MECHANISM	EHP GC



When piston *1* is moved to the left by the action of fluid delivered to the right end of its cylinder, the clamping force is transmitted to levers *2* through flat springs *3*. One end of the springs is rigidly secured to the levers and the other, bent into a loop, engages an annular groove of collar *4* which is mounted on piston rod *5*. Eight levers *2* turn about fixed axes *A*, clamping the workpiece which is located on its bore *a* at eight points. The workpiece is released and the levers are retracted within the bore when piston *1* is moved to the right by spring *6*.

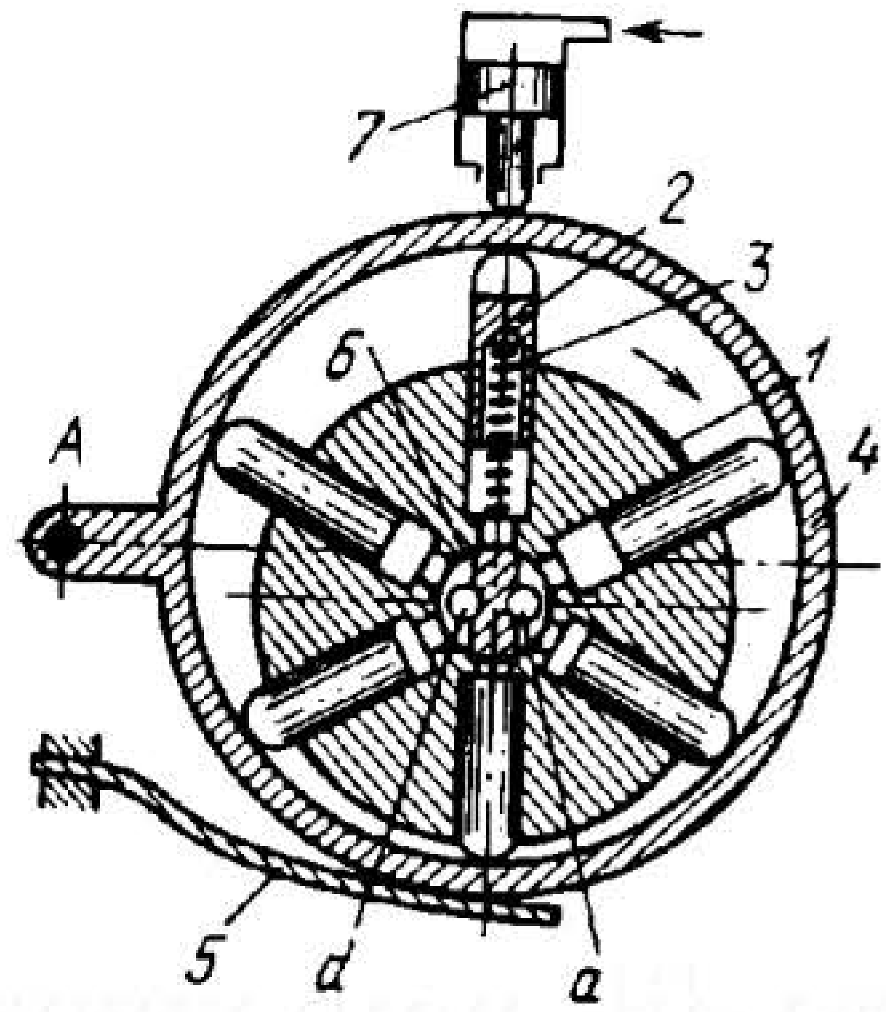
4115	FOUR-JAW HYDRAULIC CHUCK MECHANISM	EHP GC



When piston *1* is moved to the left by the action of fluid delivered to the right end of its cylinder, tapered bushing *2*, rigidly mounted on the piston rod, turns elastic levers *3* about fixed axes *A*. The levers actuate four plungers *4* which locate and clamp the workpiece. As the elastic levers are deformed, they compensate for variations in the sizes of the workpieces. The workpiece is released when piston *1* is moved to the right by spring *5*.

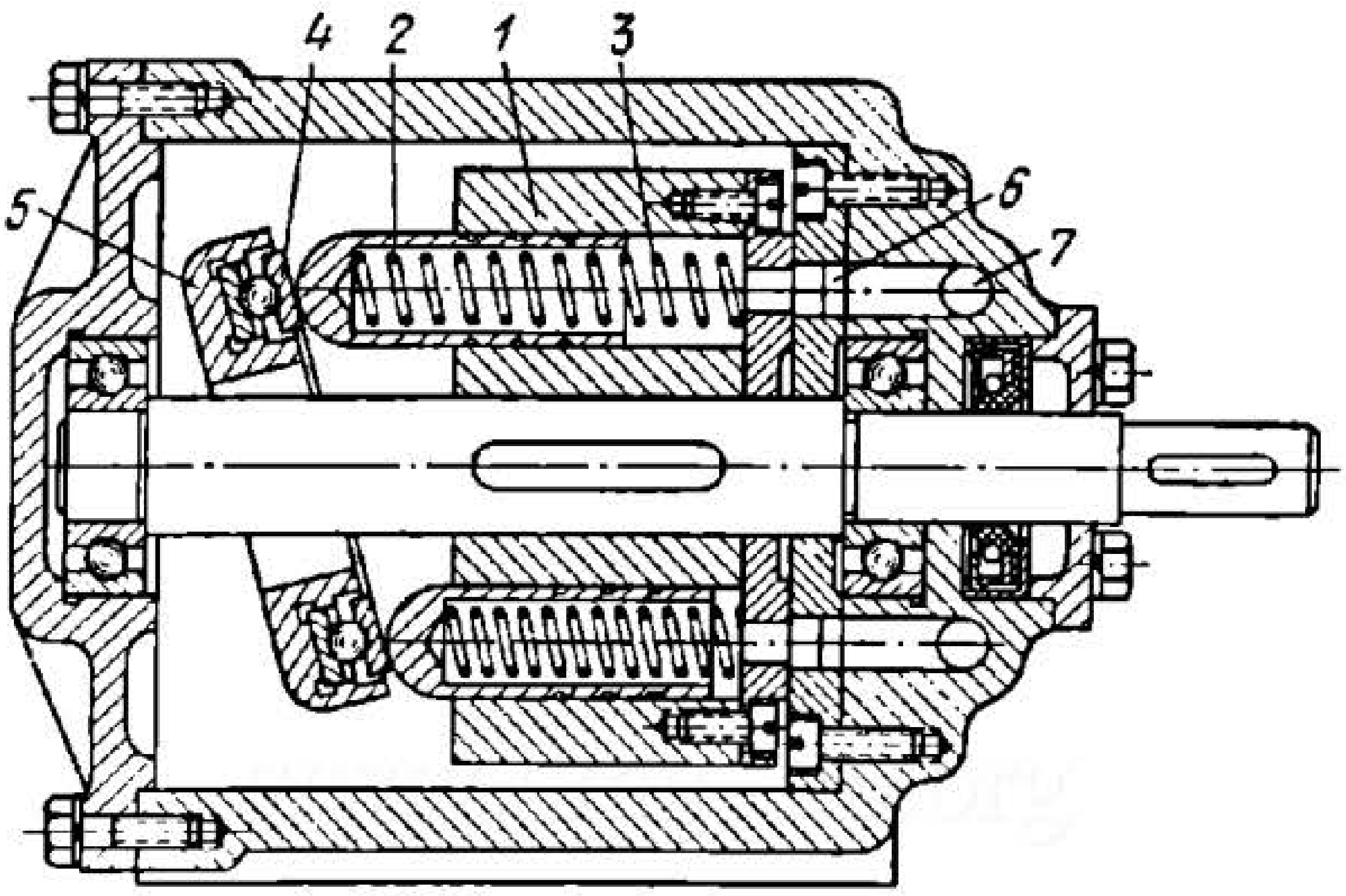
5. ROTARY VANE AND PISTON PUMP MECHANISMS (4116 through 4120)

4116	ROTARY PISTON PUMP MECHANISM WITH AUTOMATICALLY VARIABLE DISPLACEMENT	EHP RP



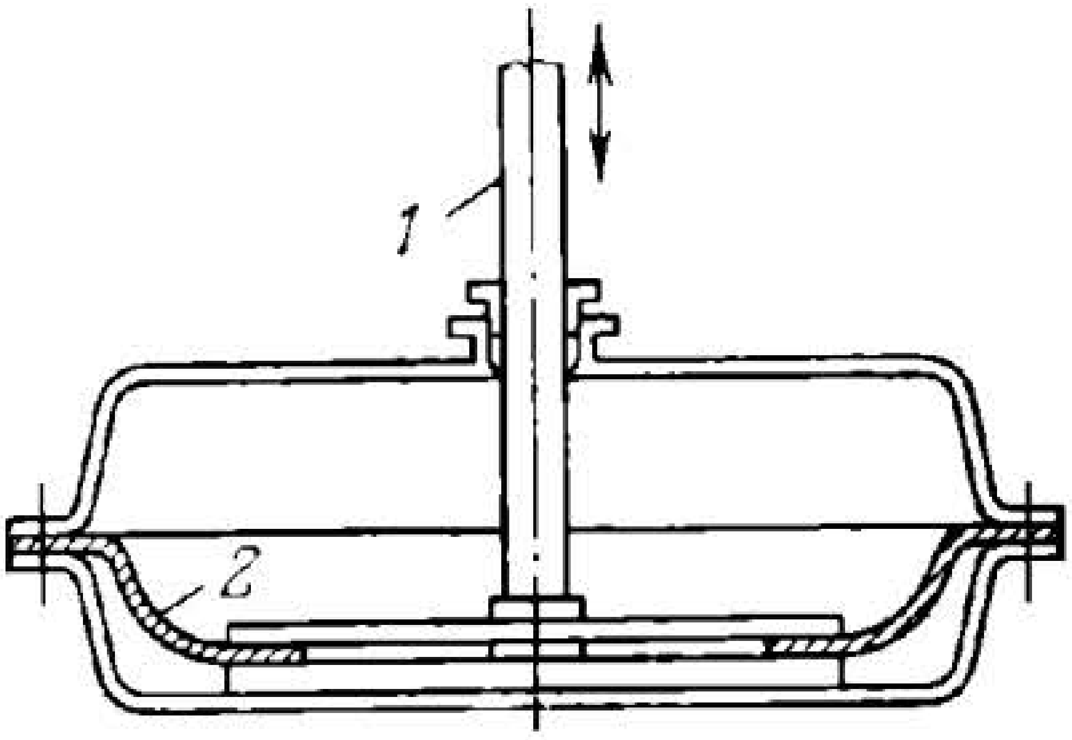
When cylinder block *1* rotates, pistons *2* reciprocate in its cylinders, held by centrifugal force and springs *3* against housing *4*. Fluid is drawn in and discharged through bores *a* and *d* in stationary shaft *6*. Flat spring *5* holds housing *4*, turning about fixed axis *A*, in the position in which the pistons have their maximum stroke and the pump, maximum delivery. When the maximum pressure of the fluid is reached, it forces piston 7 downward, turning housing *4* clockwise and bending spring *5* back, until the geometric axis of the housing approaches the axis of rotation of cylinder block *1*. When the two axes coincide, the pump delivery equals zero.

4117	AXIAL PISTON ROTARY PUMP WITH PRESSURE SPRINGS	EHP RP



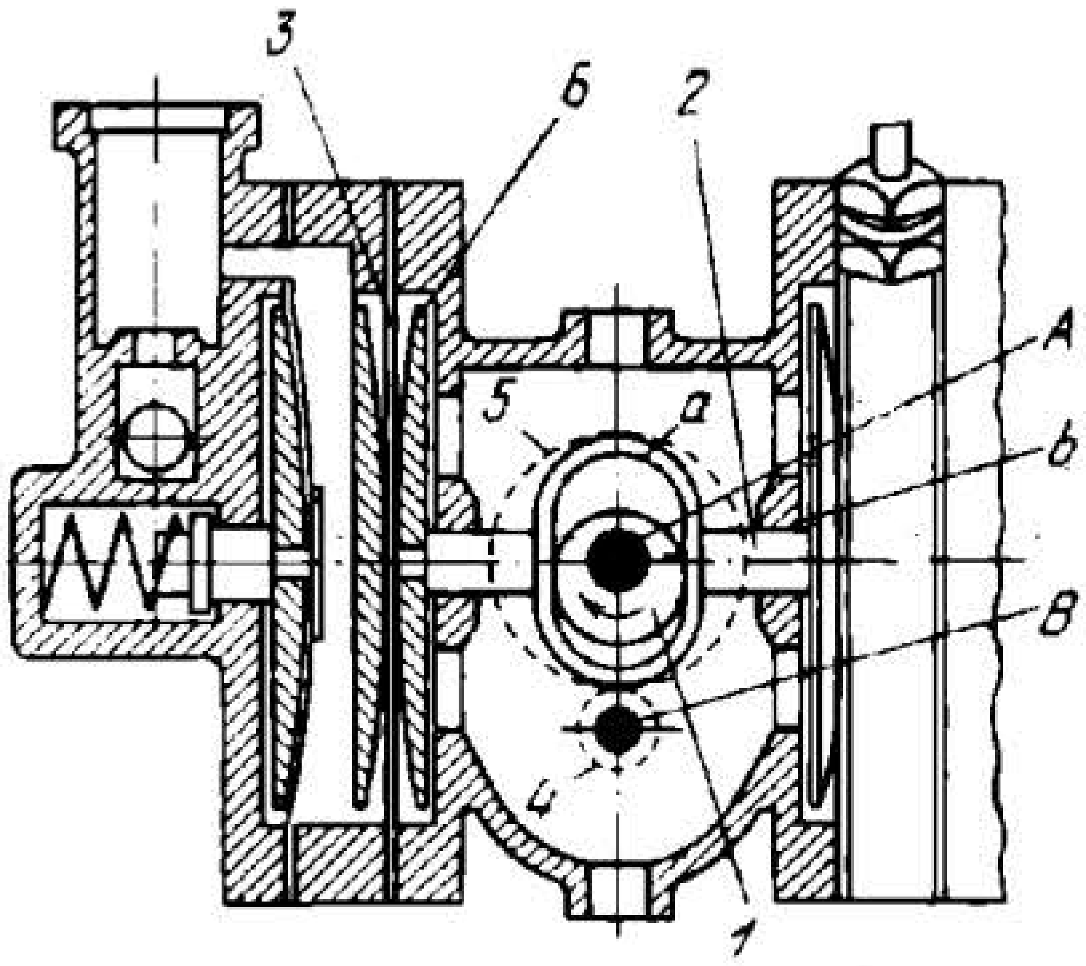
Upon rotation of cylinder block *1*, pistons *2* reciprocate in axial bores of the cylinder block, being held by springs *3* against stationary swash plate *5*. Thrust ball bearing *4* is mounted in swash plate *5* to reduce friction losses between pistons *2* and the plate. The fluid being pumped is delivered through crescent-shaped openings *6* and channels 7 into the hydraulic system.

4118	LEVER MECHANISM OF A DIAPHRAGM-TYPE AIR BLOWER	EHP RP



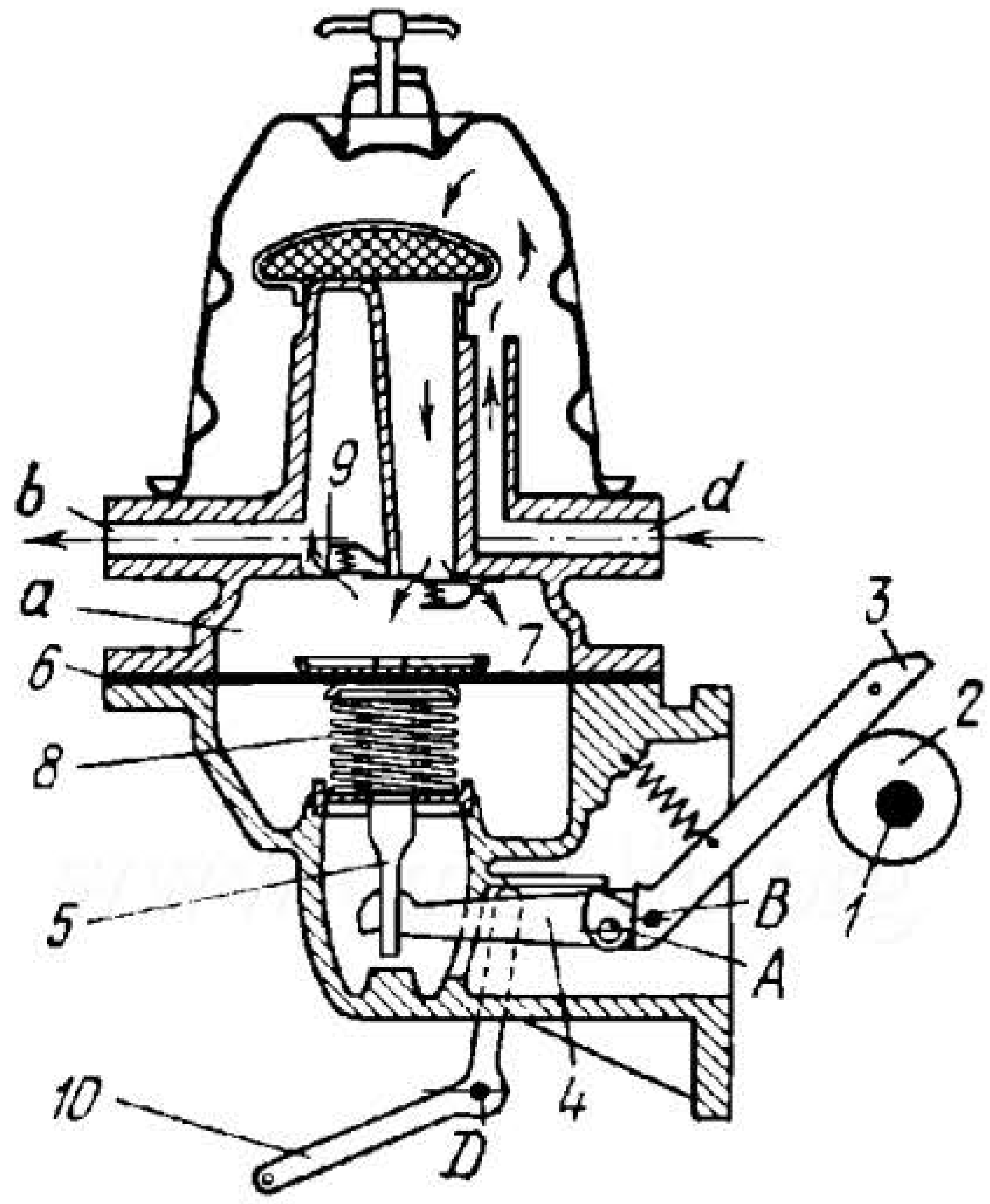
Upon reciprocation of rod *1*, fastened to elastic diaphragm *2*, the pressure is alternately increased and decreased. This is used to pump air.

4119	CAM-GEAR MECHANISM OF AN ELASTIC-DIAPHRAGM PUMP	EHP RP



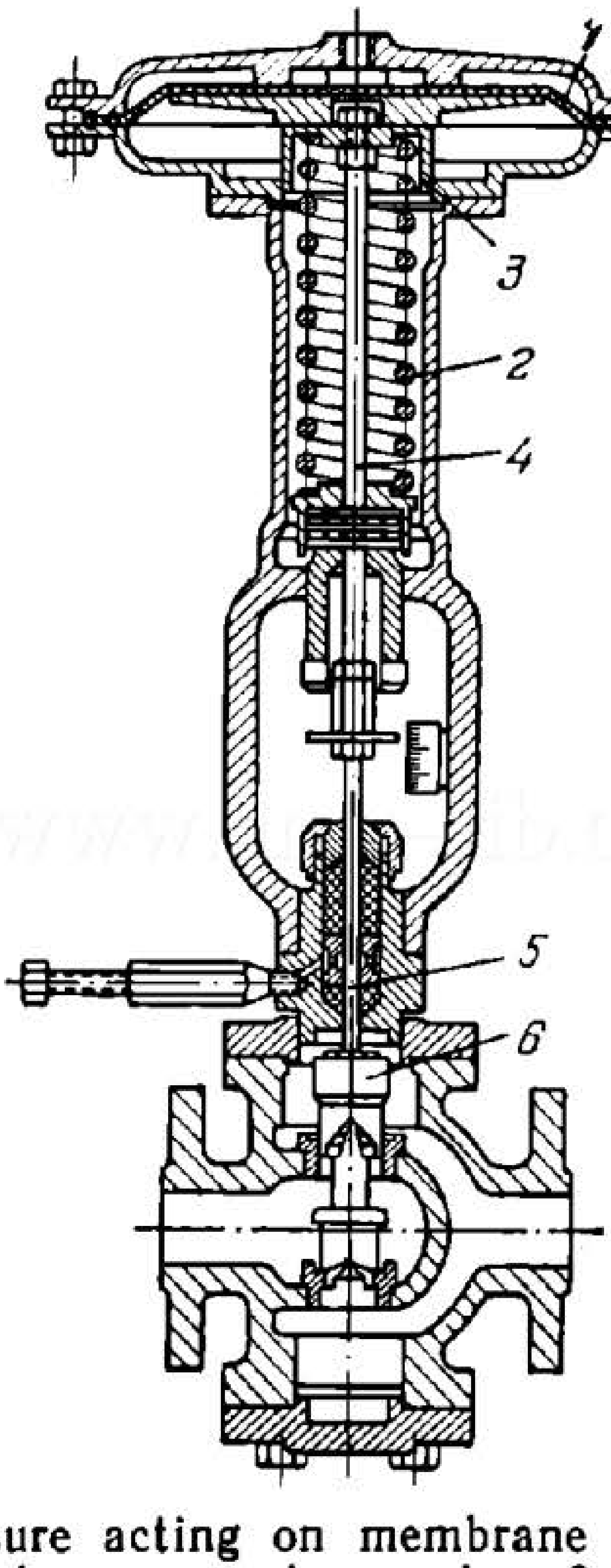
Cam *1*, designed as a circular disk, rotates about fixed sxis *A* eccentrically losated with respect to the geometric axis of the cam, and is driven by two gears, *4* and *5*. The cam is enclosed in slot *a* of slider *2*, reciprocating in fixed guides *b* and having at its ends plates *6* which contact and deform elastic diaphragms *3*. This alternately increases and decreases the pressure in the chambers beyond the diaphragms and is used as the pumping action.

4120	LEVER MECHANISM OF A DIAPHRAGM FUEL PUMP	EHP RP

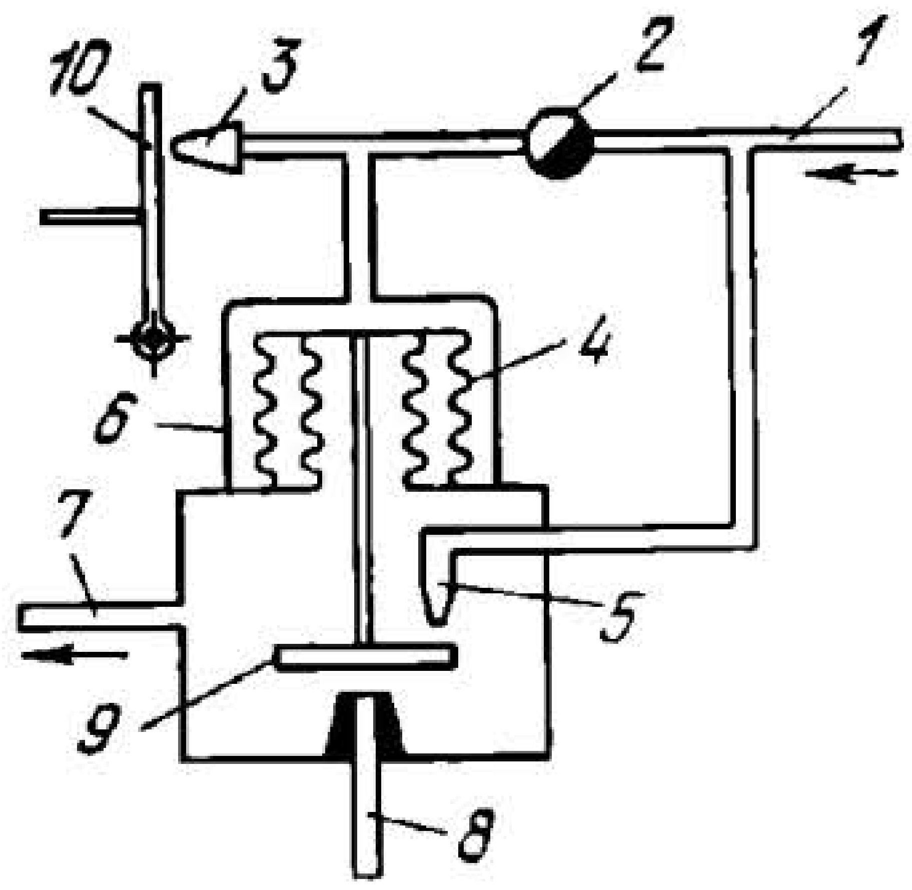


Upon rotation of camshaft *1*, rigidly mounted cam *2* oscillates lever *3* about fixed axis *B*. Through lever *4* and rod *5*, this motion lowers diaphragm *6*. When the diaphragm moves downward, a vacuum is created in chamber *a*, and gasoline is drawn in through channel *d* and inlet check valve 7. In further rotation of cam *2*, spring *8* raises diaphragm *6*. At this, inlet valve 7 closes, discharge check valve *9* opens, and the gasoline is delivered under pressure to channel *b*. Lever *10*, turning about fixed axis *D*, turns lever *4* about axis *A* and serves for pumping fuel manually.

4121	MEMBRANE SERVOMOTOR MECHANISM	EHP Dr

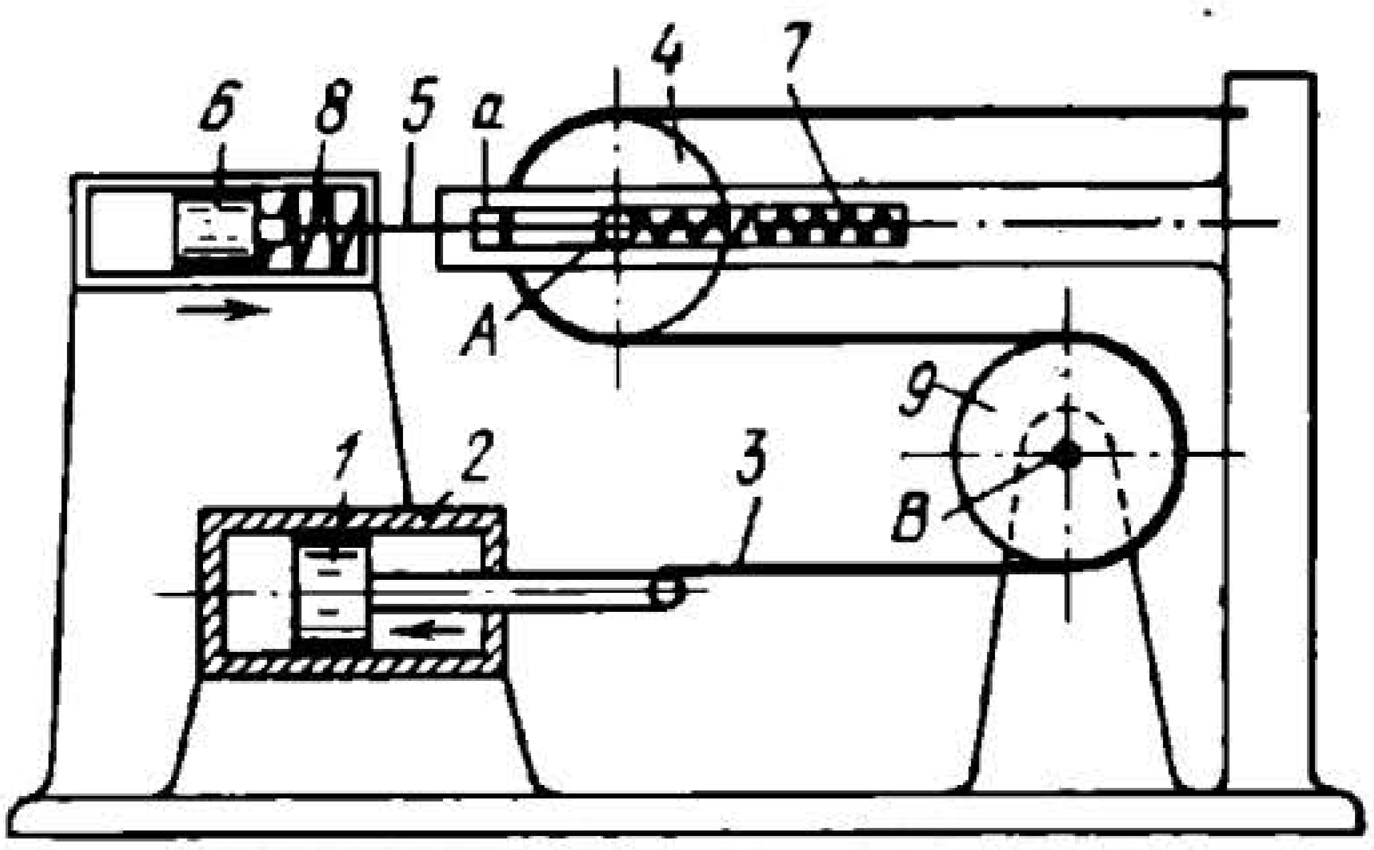


When the pressure acting on membrane *1* increases, link *3* moves downward, compressing spring *2*, and lowers rod *4* which is rigidly attached to rod *5*. This reduces the amount of fluid passing through the openings of plunger *6*. When the pressure acting on membrane *1* decreases, the amount of fluid admitted by the regulating member increases.



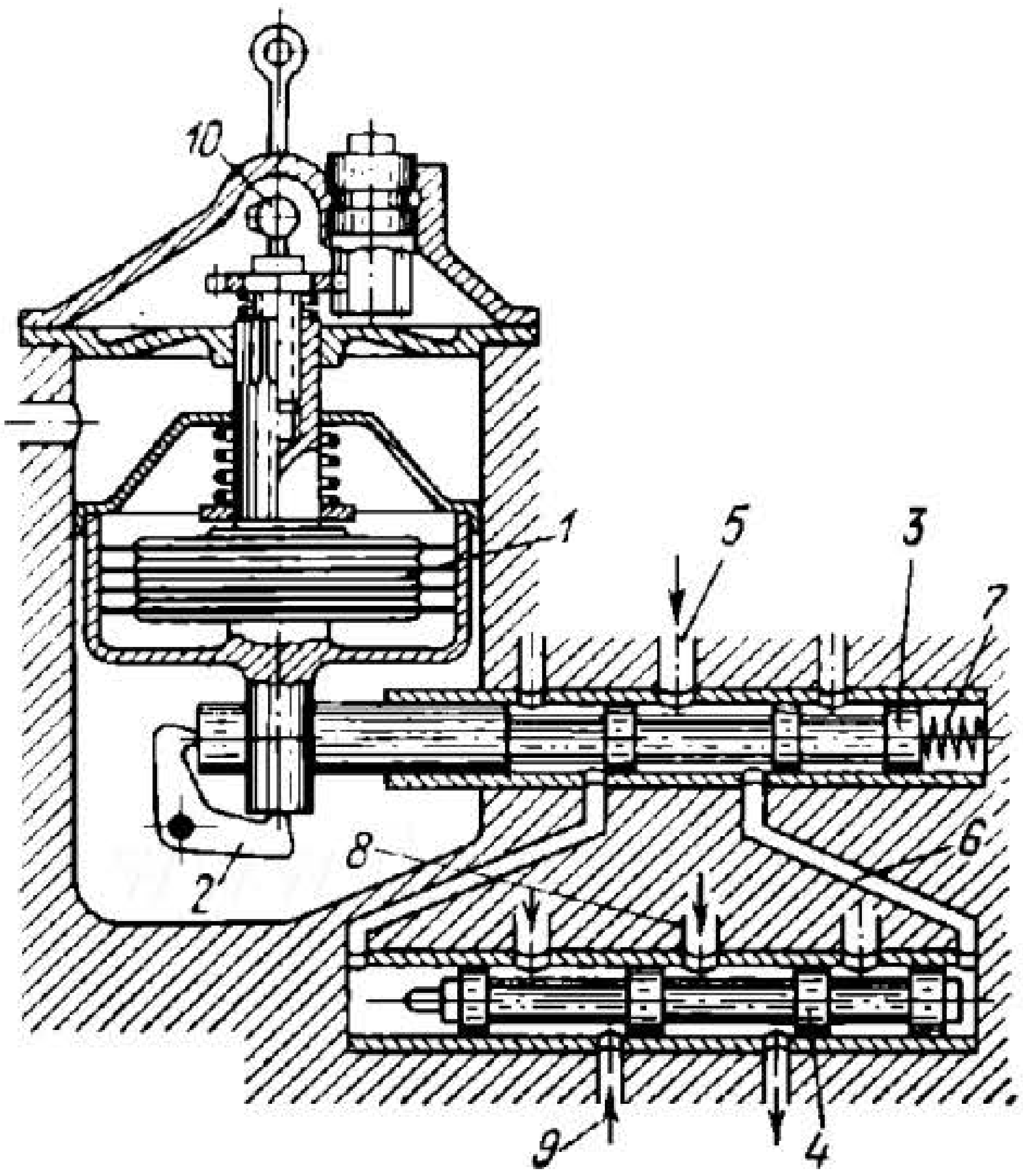
A part of the compressed air delivered through pipeline *1* passes through flow-control valve *2* to nozzle *3* and to the space between bellows *4* and housing *6*. The remainder of the air passes through tube *5* to the internal chamber of the amplifier from where it is partly discharged to the atmosphere through tube *8* and partly to the servomotor through tube *7*. Valve plate *9*, linked to the bellows by a rod, is located between the openings of tubes *5* and *8*. When shutter *10* approaches nozzle *3*, the pressure above bellows *4* increases, plate *9* is lowered, opening tube *5* somewhat and closing tube *8* to some extent. At this, the pressure of the air is increased in the internal chamber of the amplifier and, consequently, in the membrane servomotor (not shown).

4123	DRIVE MECHANISM WITH A FLEXIBLE LINK	EHP Dr

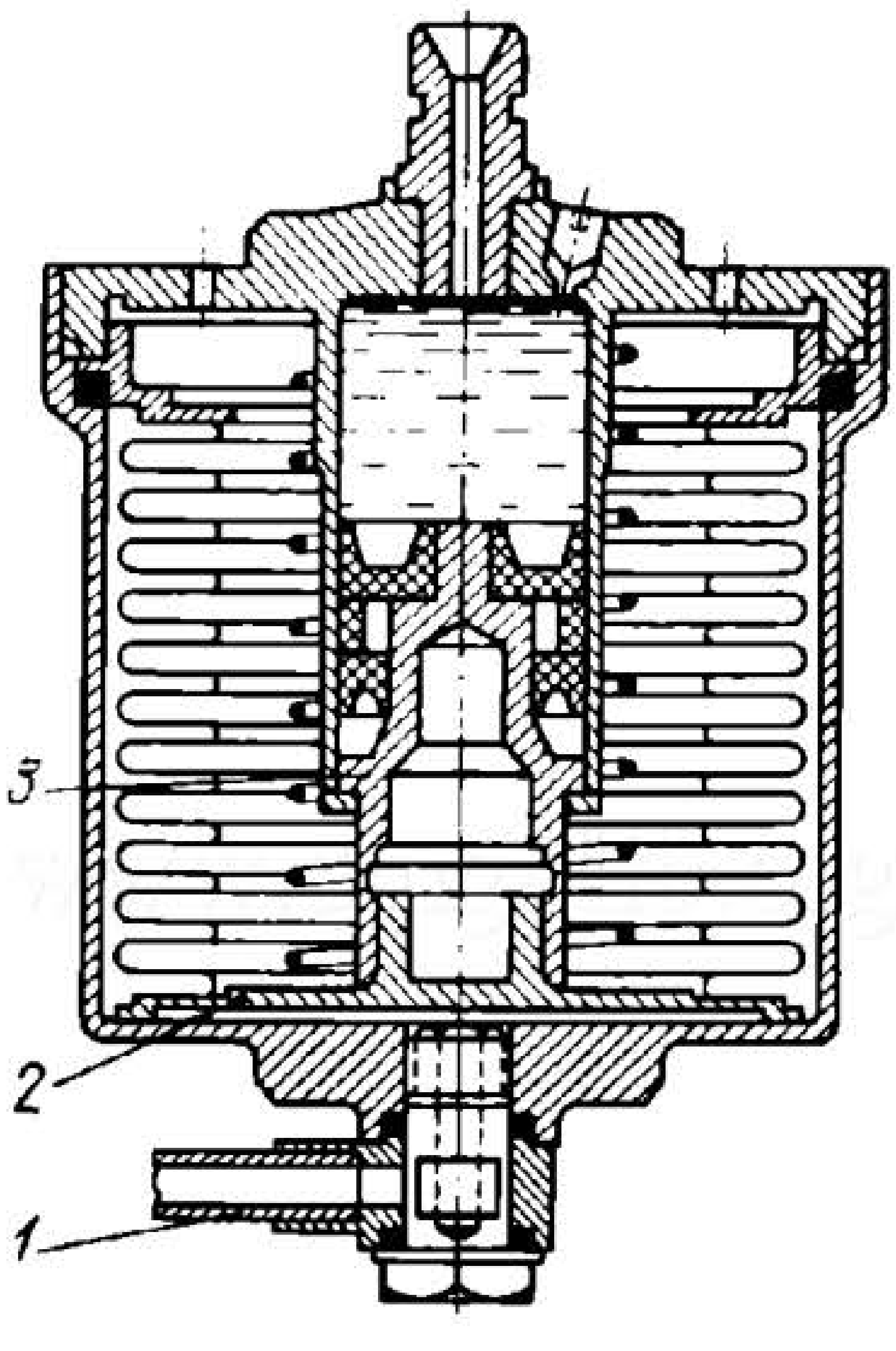


Piston *1* is moved to the left by the action of fluid delivered to the right end of cylinder *2*. This motion is transmitted to slider *6* through flexible steel belt *3*. Belt *3* runs over pulley *9*, rotating about fixed axis *B*, and pulley *4*, rotating about axis *A*, which slides along slot *a* of the upright and is subject to the action of spring *7*. Axle *A* is connected by flexible link *5* to slider *6* which moves to the right, overcoming the resistance of spring *8*.

4124	CONTROL MECHANISM FOR CHANGING SPEEDS OF AN AIRCRAFT ENGINE SUPERCHARGER	EHP Co

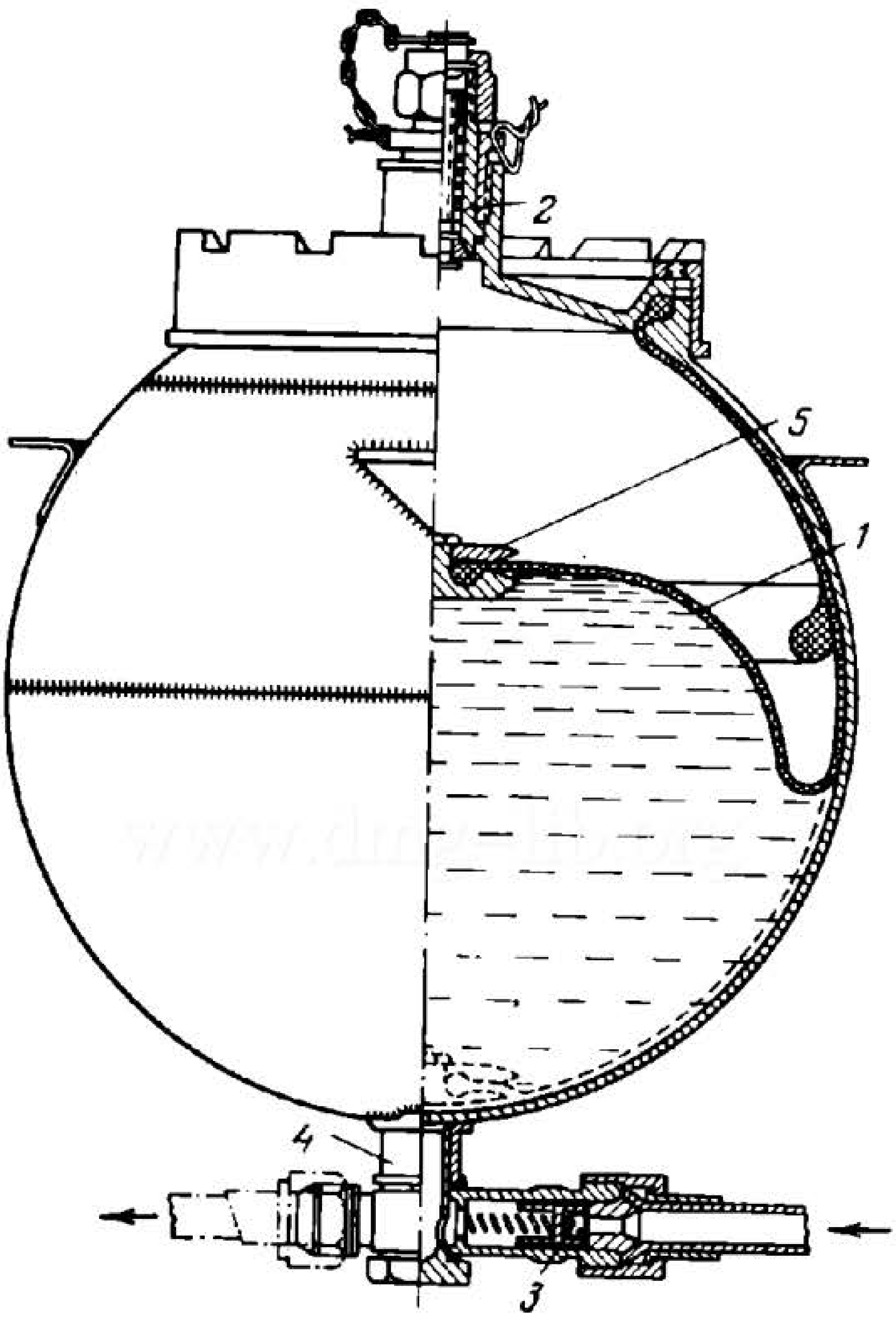


The pressure inside aneroid *1* is constant. As the aircraft climbs, aneroid *1* expands and, through bell-crank lever *2*, shifts pilot valve spool *3* to the right, compressing spring *7*. When the aircraft reaches a certain altitude, spool *3* admits fluid from passage *5* through passage *6* to the right end of main valve spool *4*, shifting this spool rapidly to the left. Then fluid from the pump is delivered through passages *8* and *9* to the speed-changing mechanism. The altitude at which the speeds are changed can be regulated by cam *10* which raises or lowers the aneroid housing.



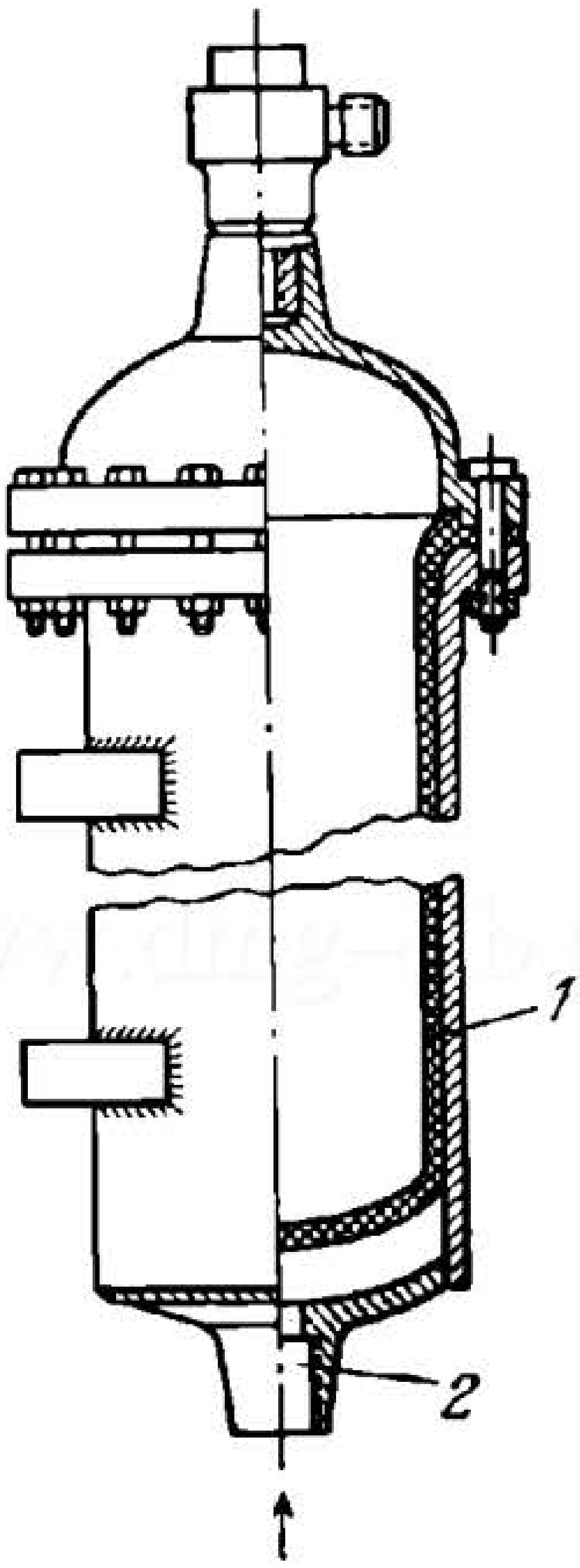
Compressed air is delivered through pipeline *1*. The pressure of the air is transmitted to corrugated membrane *2*, which is compressed and moves piston *3*. Piston *3* forces out the fluid into the brake cylinders, effecting the braking action.

4126	HYDROPNEUMATIC SPHERICAL ACCUMULATOR MECHANISM	EHP FD



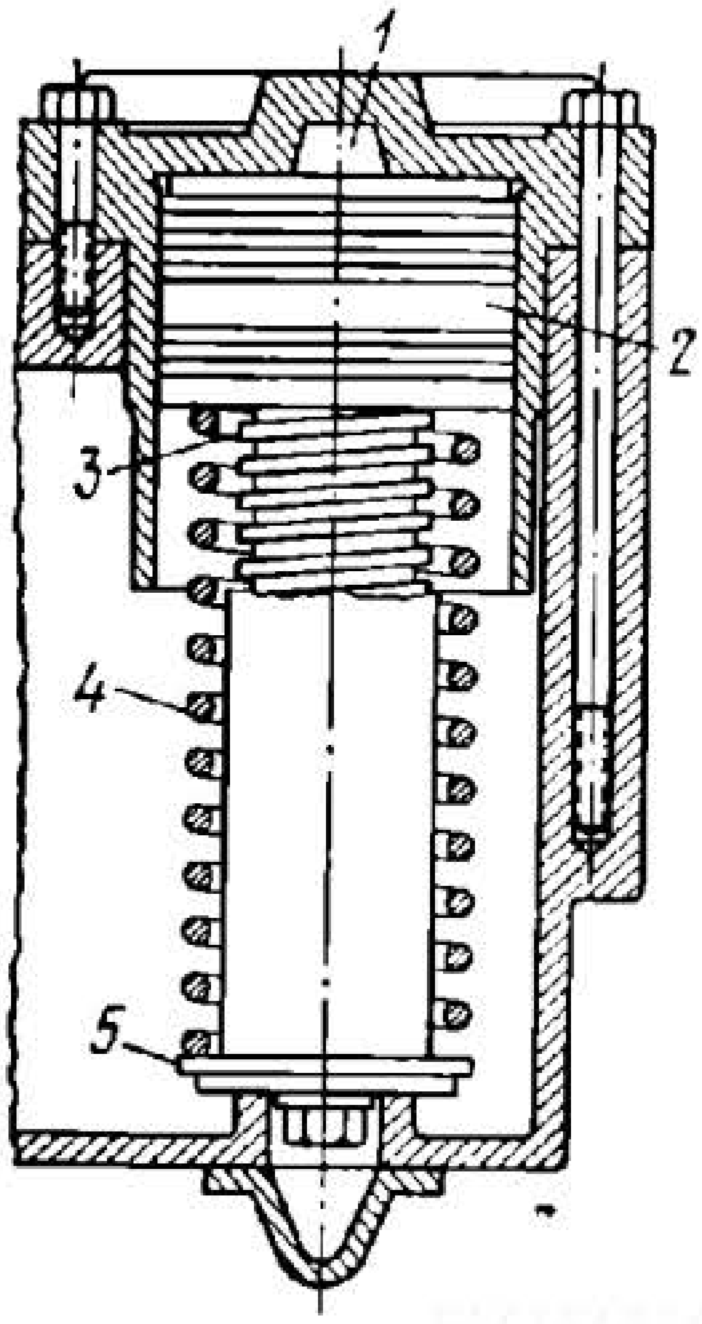
Owing to the action of the liquid, rubber membrane *1*, separating the hydraulic and pneumatic chambers, is bent upward, compressing the air and accumulating, in this manner, potential energy in the system. As the accumulator is put into operation, the potential energy of the compressed air is converted into kinetic energy. The accumulator is charged with air through valve *2*. Liquid is admitted into the accumulator through check valve *3*. Rigid washer *5* is provided to prevent membrane *1* from being squeezed into intake connection *4* when all the liquid is drained from the accumulator.

4127	HYDROPNEUMATIC ACCUMULATOR MECHANISM WITH A RUBBER MEMBRANE	EHP FD



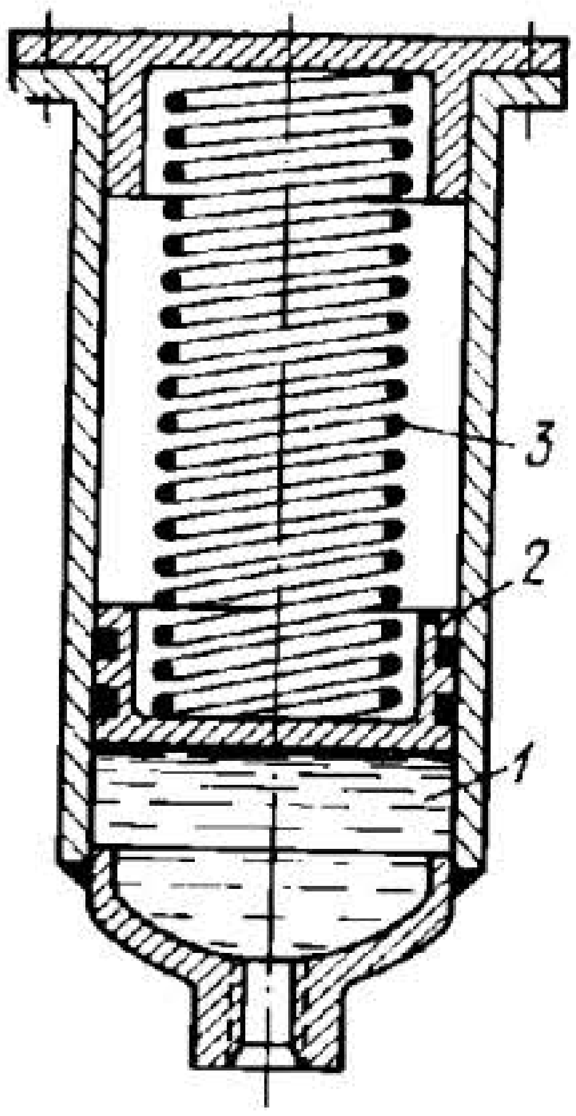
Owing to the action of the liquid admitted through port *2*, rubber membrane *1*, separating the hydraulic and pneumatic chambers, is bent upward, compressing the air and accumulating, in this manner, potential energy in the system. As the accumulator is put into operation, the potential energy of the compressed air is converted into kinetic energy. The accumulator also serves as a buffer for absorbing hydraulic impacts (water hammer) and as a compensating chamber for compensating for the change in volume of the hydraulic fluid in the system.

4128	HYDRAULIC ACCUMULATOR MECHANISM	EHP FD



When hydraulic fluid is delivered into cylinder *1*, designed integral with the cover, piston *2* moves downward, compressing springs *3* and *4*. One end of the springs bears against the bottom of piston *2* and the other against plate *5*, which rests on a boss of the housing. As the springs are compressed, energy is accumulated that can be utilized upon a drop in pressure in the system. If the pressure of the fluid increases above the permissible value, the fluid is discharged through radial holes in the cylinder (not shown) which are uncovered by the piston when it has travelled a certain distance downward.

4129	SPRING-TYPE ACCUMULATOR MECHANISM	EHP FD



When the pressure increases in chamber *1*, piston *2* moves upward, compressing spring *3*, which thereby accumulates potential energy in the system.

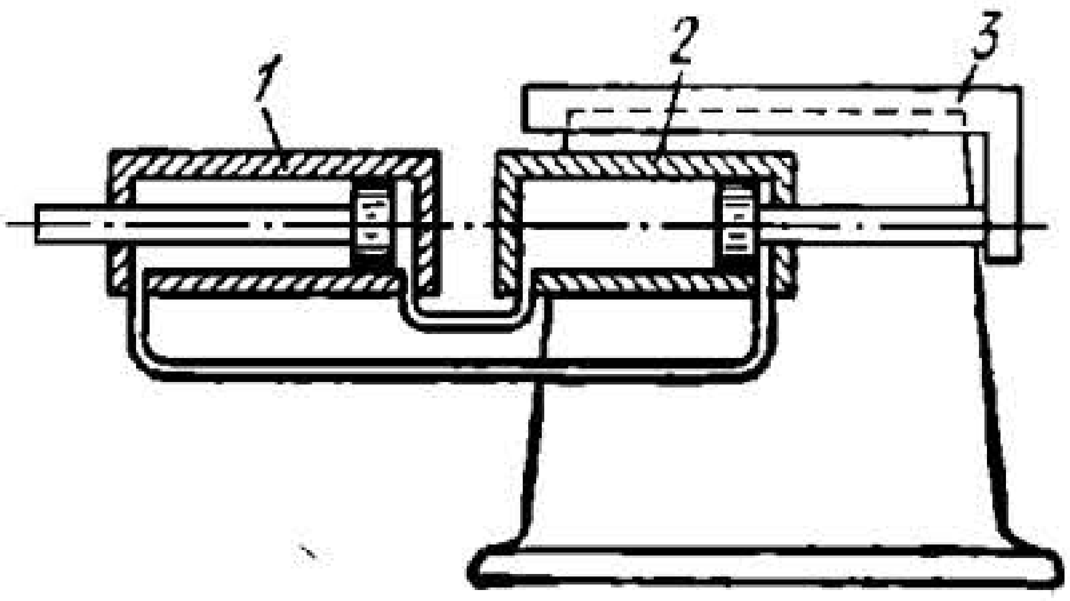
SECTION THIRTY-TWO

Complex Hydraulic and Pneumatic Mechanisms CHP

1. Drive Mechanisms Dr (4130 through 4224)
2. Regulator Mechanisms Rg (4225 through 4274)
3. Hammer, Press and Die Mechanisms HP (4275 and 4276)
4. Aircraft Landing Gear Mechanisms AL (4277 through 4281)
5. Mechanisms of Measuring and Testing Devices M (4282)
6. Mechanisms of Materials Handling Equipment MH (4283 and 4284)
7. Gripping, Clamping and Expanding Mechanisms GC (4285 through 4293)
8. Brake Mechanisms Br (4294 through 4300)
9. Relay Mechanisms Re (4301)
10. Mechanisms of Other Functional Devices FD (4302 through 4310)

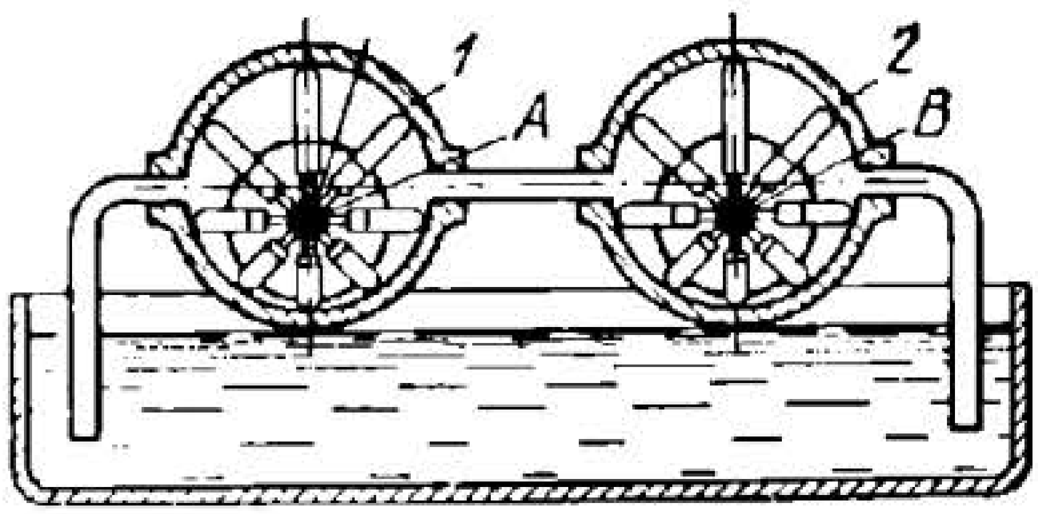
1. DRIVE MECHANISMS (4130 through 4224)

4130	PISTON DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



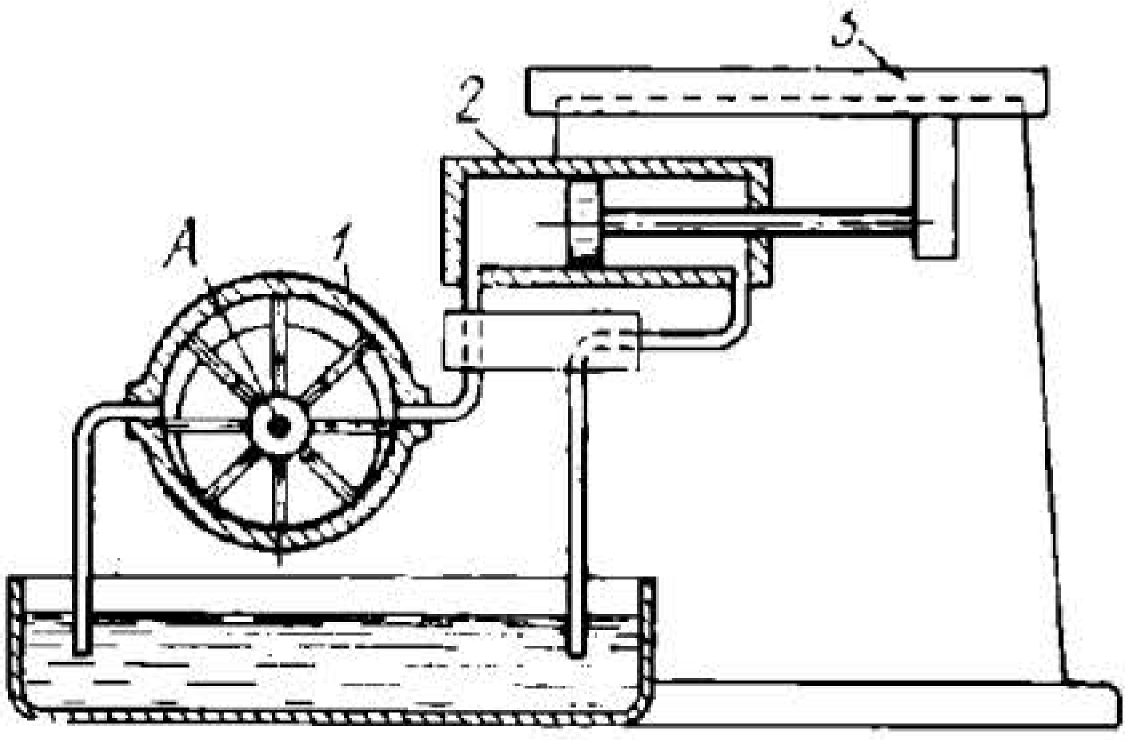
Reciprocating motion of the piston of hydraulic pump *1* is converted into reciprocating motion of the piston of hydraulic cylinder *2* and machine tool table *3*, rigidly attached to the piston rod of cylinder *2*.

4131	ROTARY DRIVE MECHANISM OF A MACHINE TOOL	CHP Dr



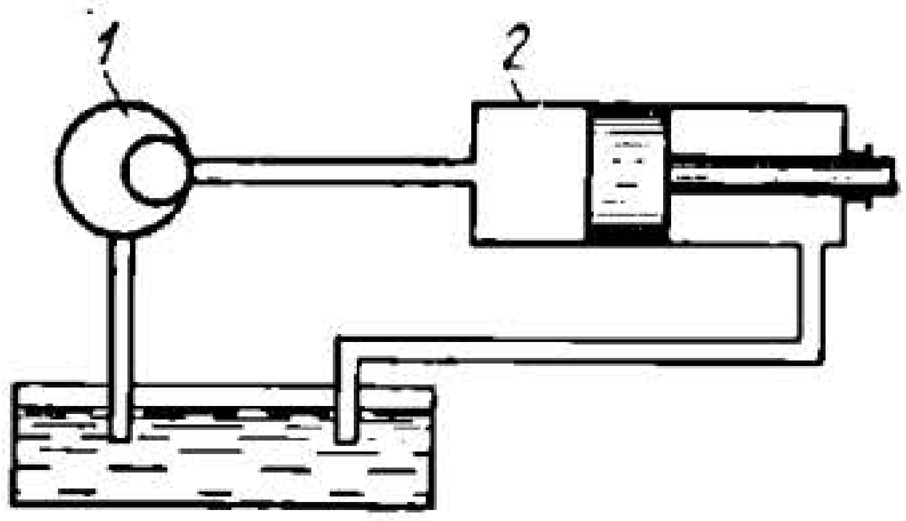
Rotation of the rotor of rotary hydraulic pump *1* about fixed axis *A* is transmitted to the rotor of hydraulic motor *2*, linked to the shaft of the machine tool and rotating about fixed axis *B*.

4132	COMBINED DRIVE MECHANISM OF A MACHINE TOOL	CHP Dr



Rotation of the rotor of rotary hydraulic pump *1* about fixed axis *A* is converted into reciprocating motion of the piston of hydraulic cylinder *2* and machine tool table *3*, rigidly attached to the piston rod of cylinder *2*.

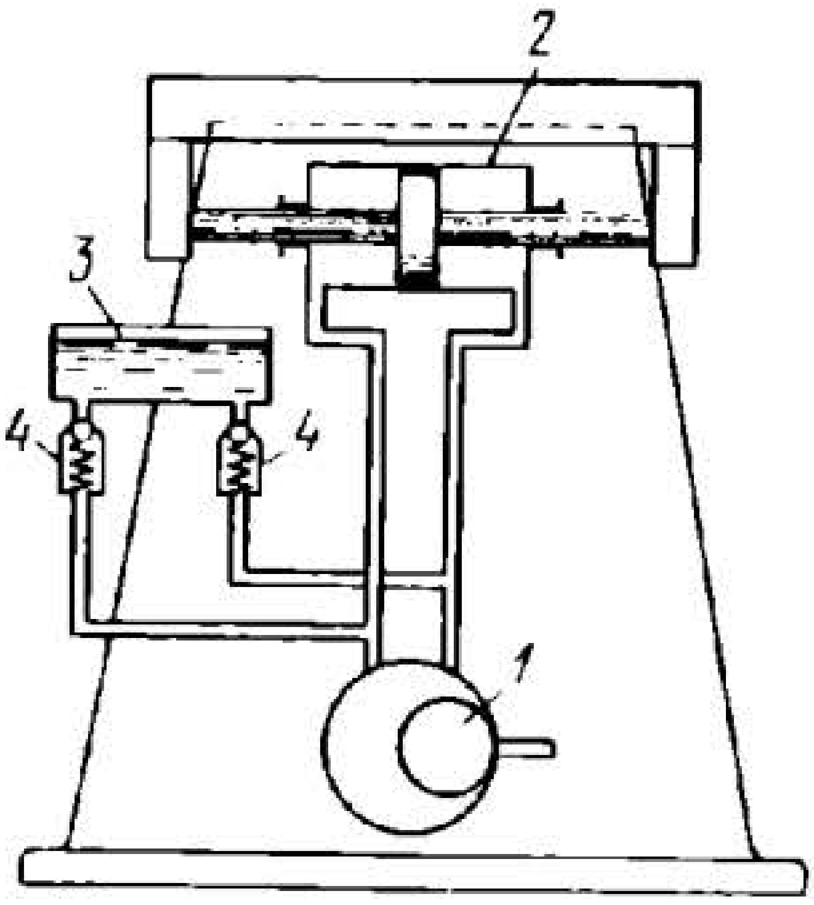
4133	OPEN-CIRCUIT HYDRAULIC DRIVE MECHANISM	CHP Dr



Fluid is delivered from the tank by variable-displacement pump *1* to the left (head) end of cylinder *2* and is exhausted from the right (rod) end back to the tank.

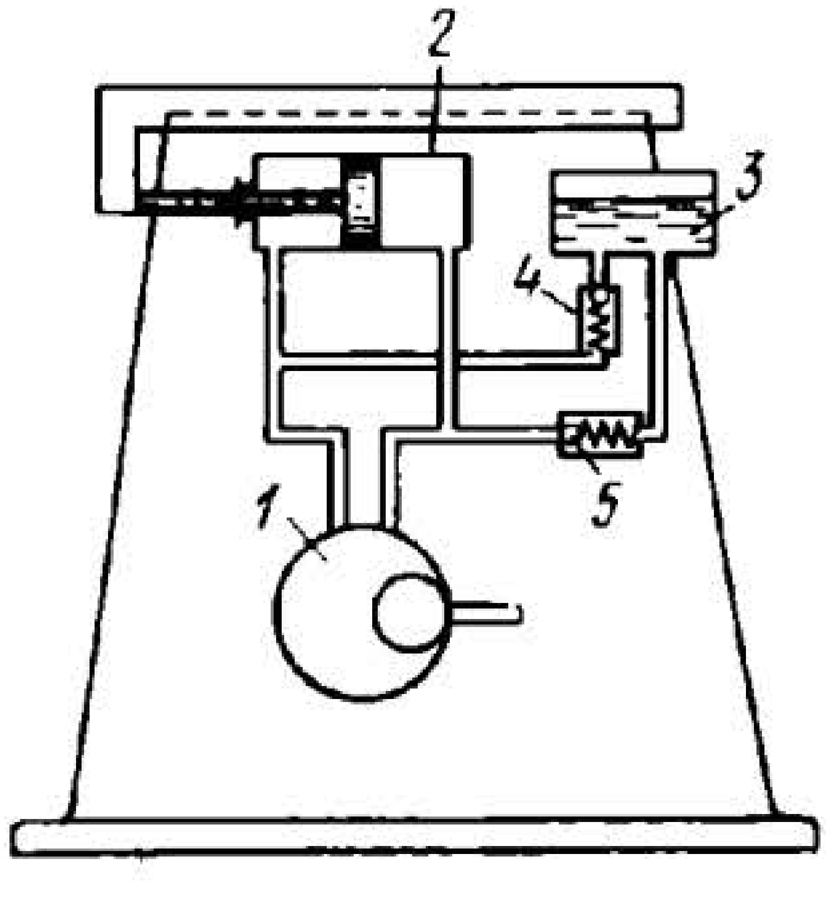
4134	CLOSED-CIRCUIT HYDRAULIC DRIVE MECHANISM	CHP Dr

Fluid is delivered by variable-displacement pump *1* from one end of power cylinder *2* to the other end, reciprocating the piston and the machine tool table rigidly attached to the piston rod. Leakage is compensated for by make-up from tank *3* through check valves *4* in the suction lines. Since in reversing motions the pipelines operate alternately as suction and discharge lines, two check valves are provided.

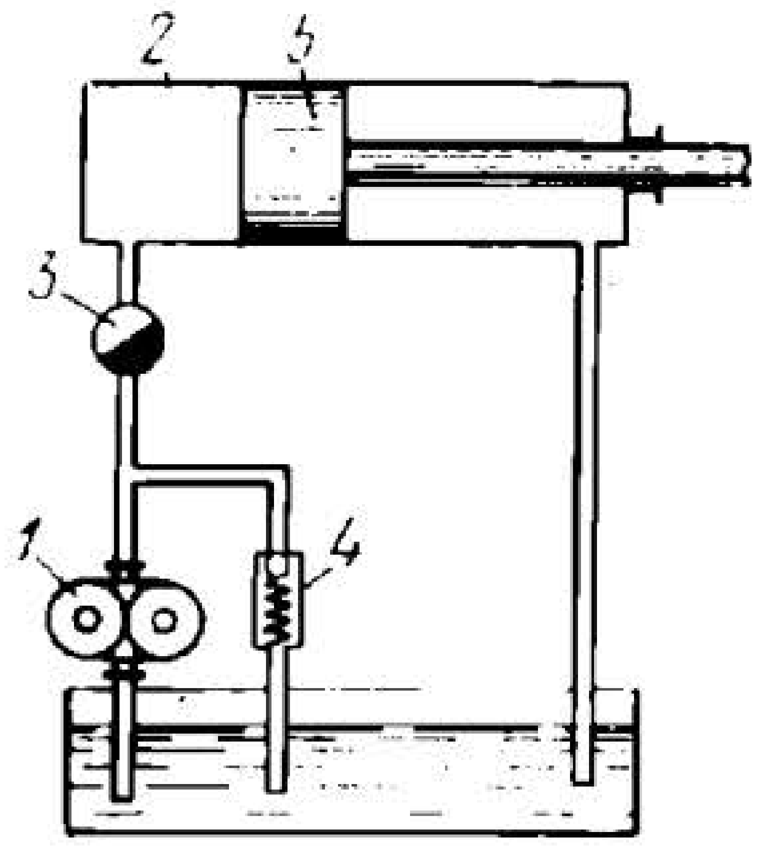


4135	CLOSED-CIRCUIT HYDRAULIC DRIVE MECHANISM	CHP Dr

Fluid is delivered by variable-displacement pump *1* from one end of power cylinder *2* to the other end, reciprocating the piston and the machine tool table, rigidly attached to the piston rod. Surplus fluid from the right end of cylinder *2* is exhausted through check valve *5* to tank *3*. On the reverse stroke, when fluid is drawn in from the left end of the cylinder and delivered to the right end, the lacking fluid is made up from tank *3* through check valve *4*.

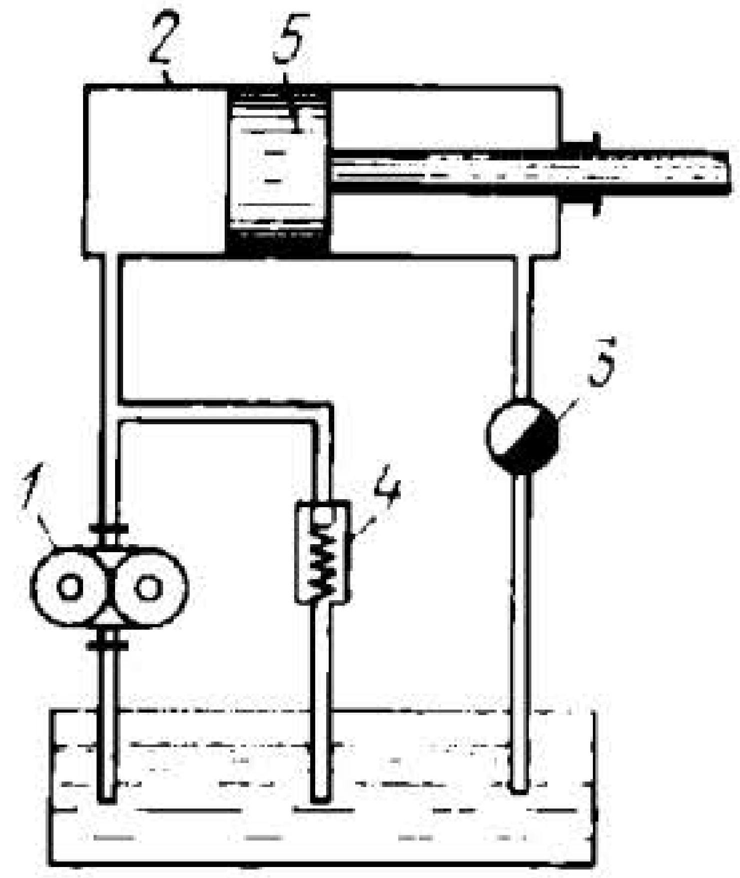


4136	HYDRAULIC DRIVE MECHANISM WITH A METERING-IN CIRCUIT	CHP Dr



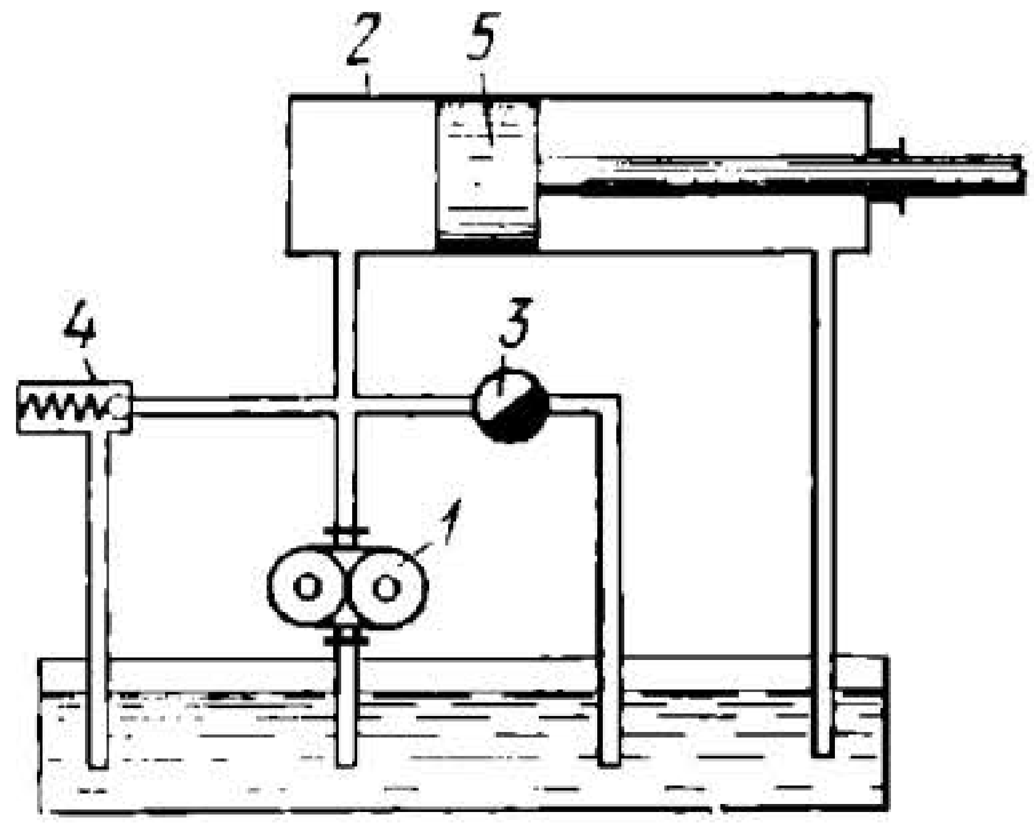
Constant-displacement pump *1* delivers fluid to the head (working) end of cylinder *2*. Flow-control valve *3*, serving to vary the speed of piston *5*, is installed in the input line to the working end of the cylinder. Pump *1* operates at constant pressure, determined by the setting of relief valve *4*, through which surplus fluid, delivered by the pump, drains back to the tank.

4137	HYDRAULIC DRIVE MECHANISM WITH A METERING-OUT CIRCUIT	CHP Dr



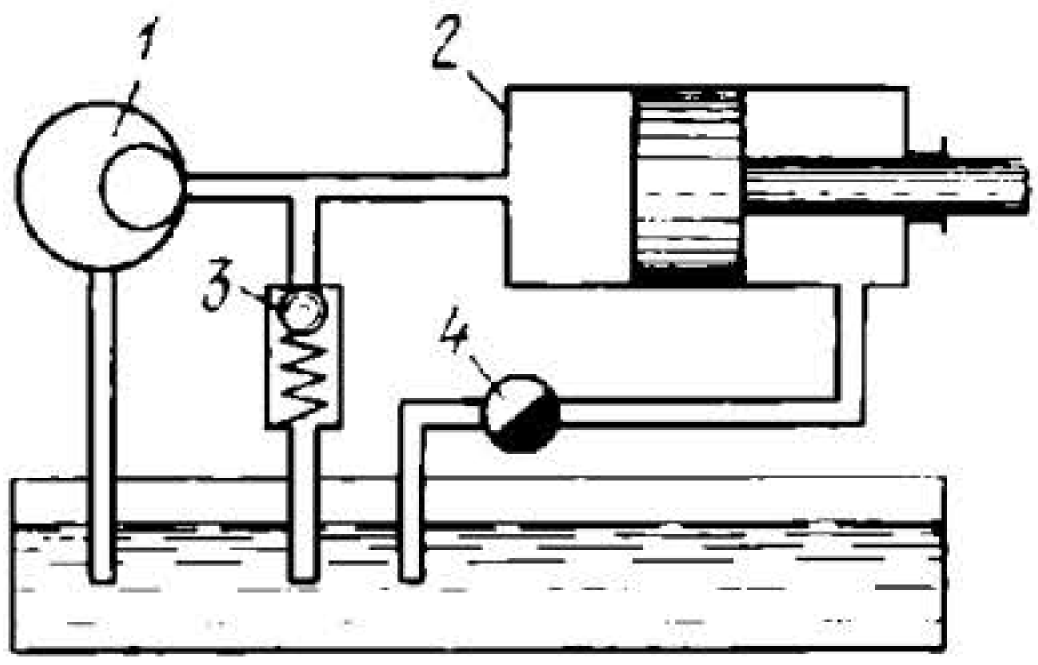
Constant-displacement pump *1* delivers fluid to the head (working) end of cylinder *2*. Flow-control valve *3*, serving to vary the speed of piston *5*, is installed in the discharge line from the exhaust end of the cylinder. The pressure of the fluid delivered by the pump is regulated by setting relief valve *4*, through which surplus fluid, delivered by the pump, drains back to the tank.

4138	HYDRAULIC DRIVE MECHANISM WITH A BLEED-OFF CIRCUIT	CHP Dr



Constant-displacement pump *1* delivers fluid to the head (working) end of cylinder *2*. Flow-control valve *3*, serving to vary the speed of piston *5*, is installed in a branch of the line from the pump to the working end of the cylinder. Relief valve *4* protects the system against overloads.

4139	HYDRAULIC DRIVE MECHANISM WITH A VARIABLE-DISPLACEMENT PUMP AND A METERING-OUT CIRCUIT	CHP Dr



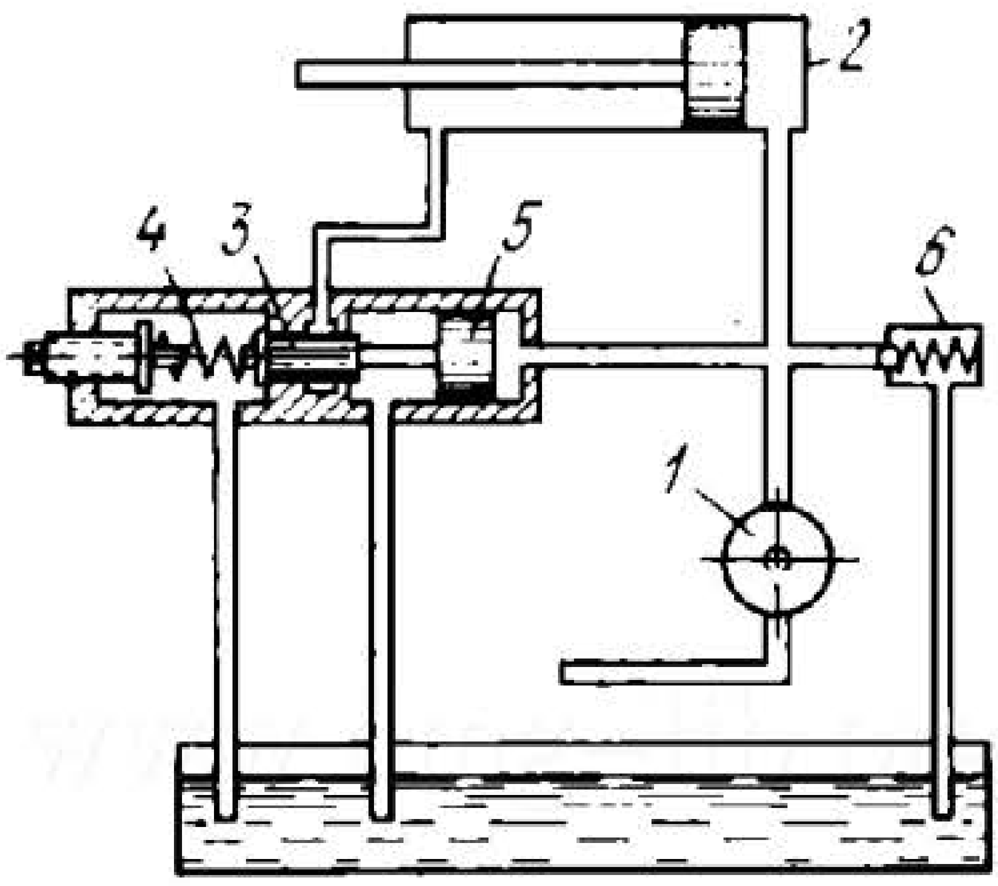
Variable-displacement pump *1* delivers fluid from the tank to the left end of cylinder *2*. Fluid from the right end of the cylinder is exhausted back to the tank through flow-control valve *4* which establishes a constant back pressure in the system. Relief valve *3* protects the system against overloads.

4140

HYDRAULIC DRIVE MECHANISM WITH CONSTANT WORKING PRESSURE

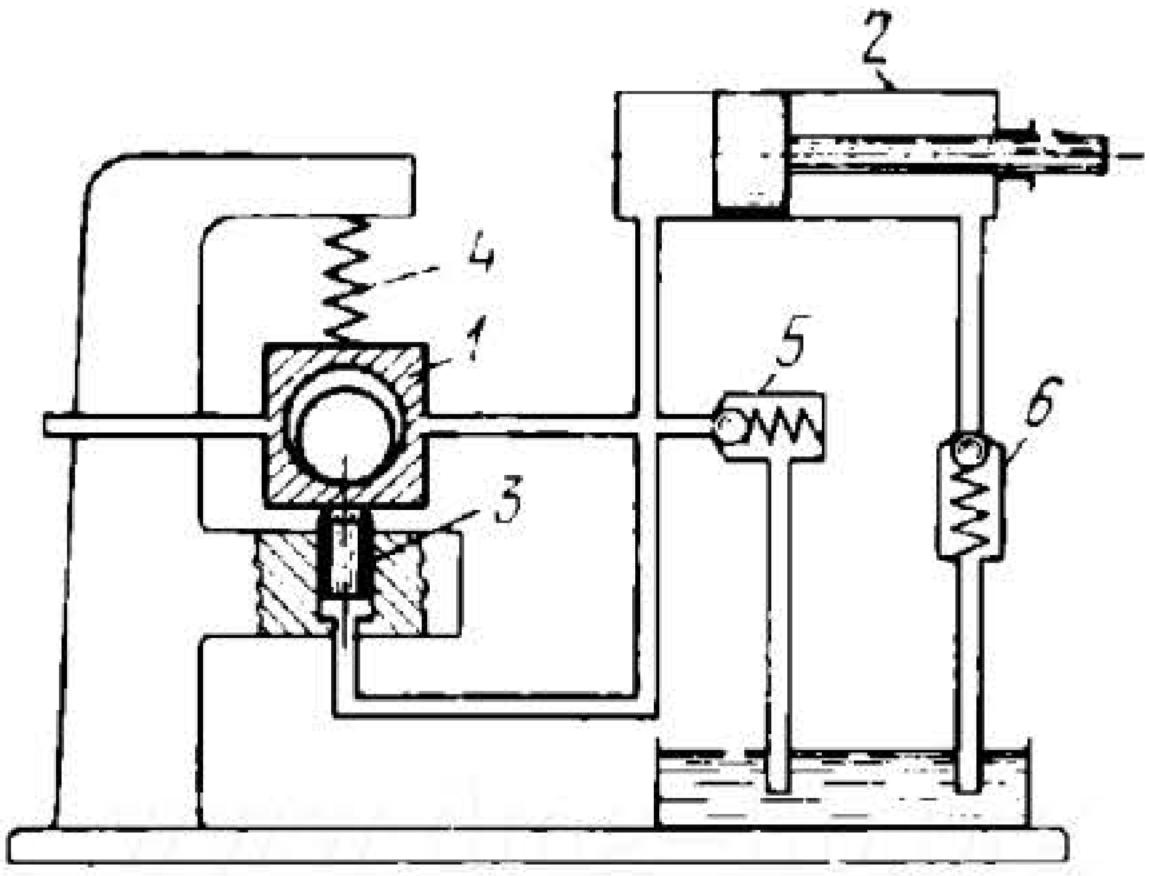
CHP

Dr



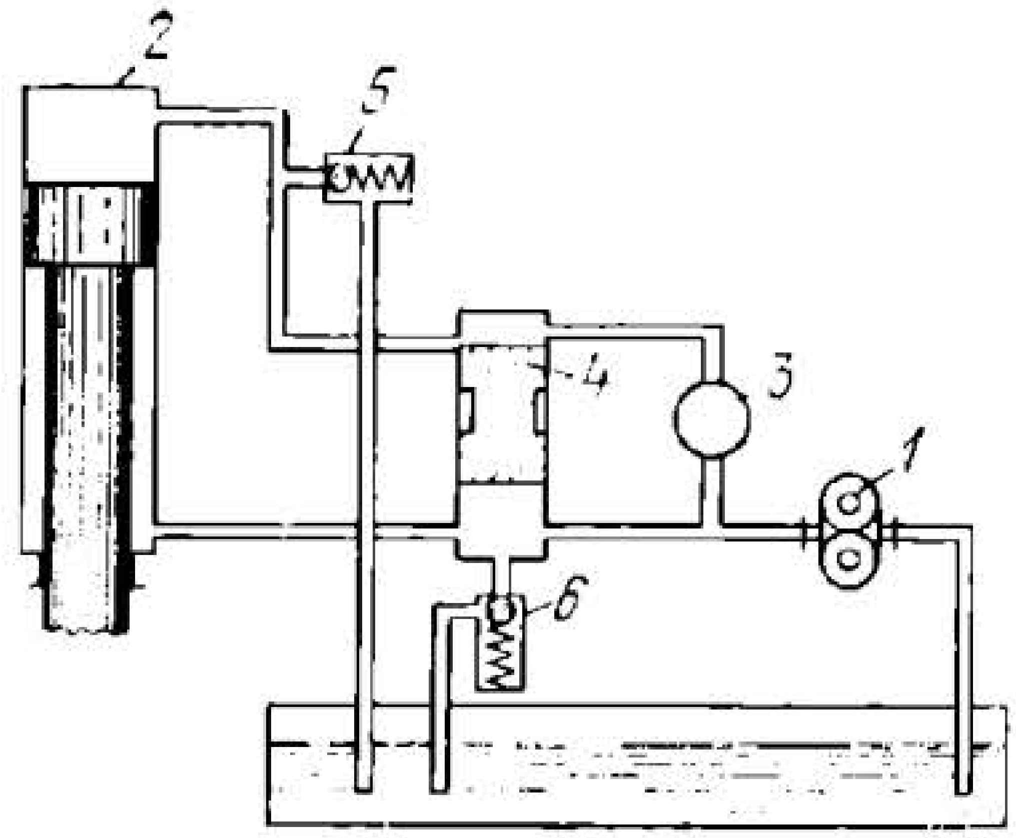
Variable-displacement rotary piston pump *1* delivers fluid to the head (working) end of cylinder *2*. Outlet from the exhaust end of the cylinder is blocked off by valve member *3*, subject to the action of spring *4* and opened by piston *5*. Spring *4* can be adjusted so that valve member *3* is opened when piston *5* is subject to a definite working pressure. Surplus fluid is discharged from the system through relief valve *6*.

4141	HYDRAULIC DRIVE MECHANISM WITH AUTOMATIC LEAKAGE COMPENSATION	CHP Dr



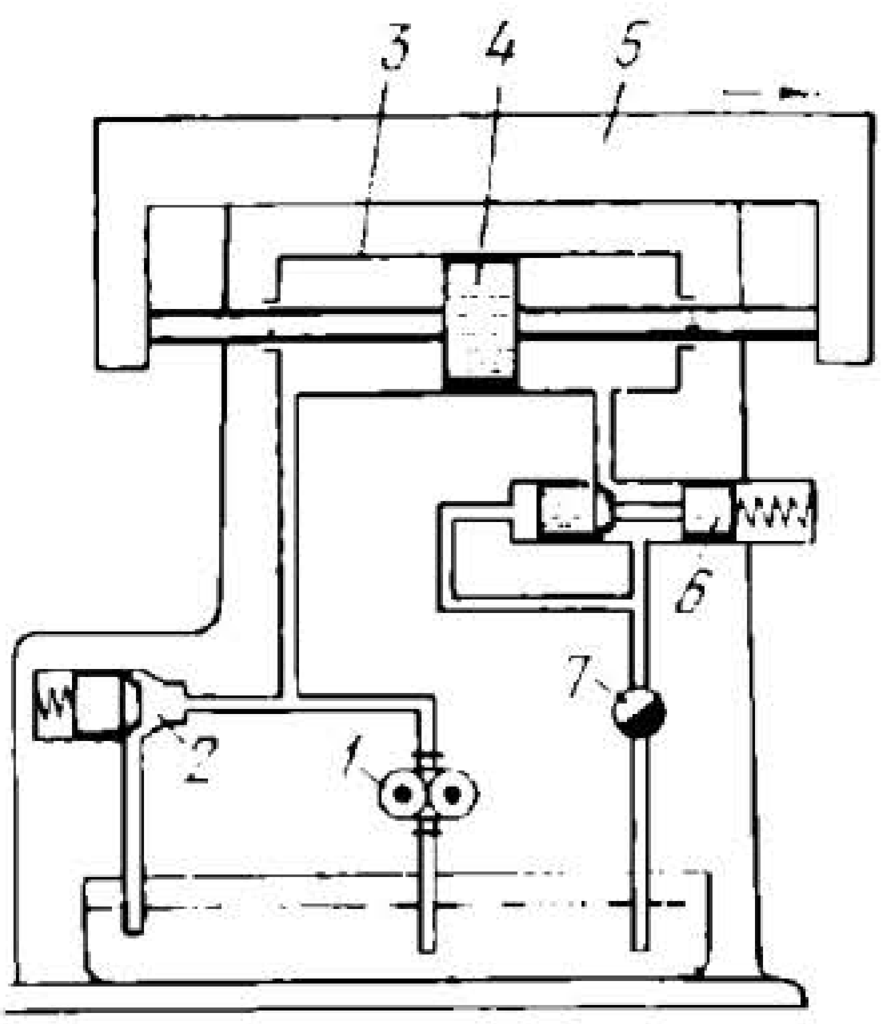
Piston *3*, subject to the working pressure developed by variable-displacement pump *1*, which delivers fluid to power cylinder *2*, overcomes the resistance of spring *4* and actuates the mechanism for increasing the pump output. By selecting spring *4* with the proper load characteristics, it is possible to compensate automatically for leakage occurring in the hydraulic system at increased pressures by increasing the output of pump *1*. Surplus fluid in the system drains back to the tank through relief valve *5*. Relief valve *6* maintains a definite back pressure in the system.

4142	HYDRAULIC DRIVE MECHANISM WITH LEAKAGE ELIMINATION	CHP Dr



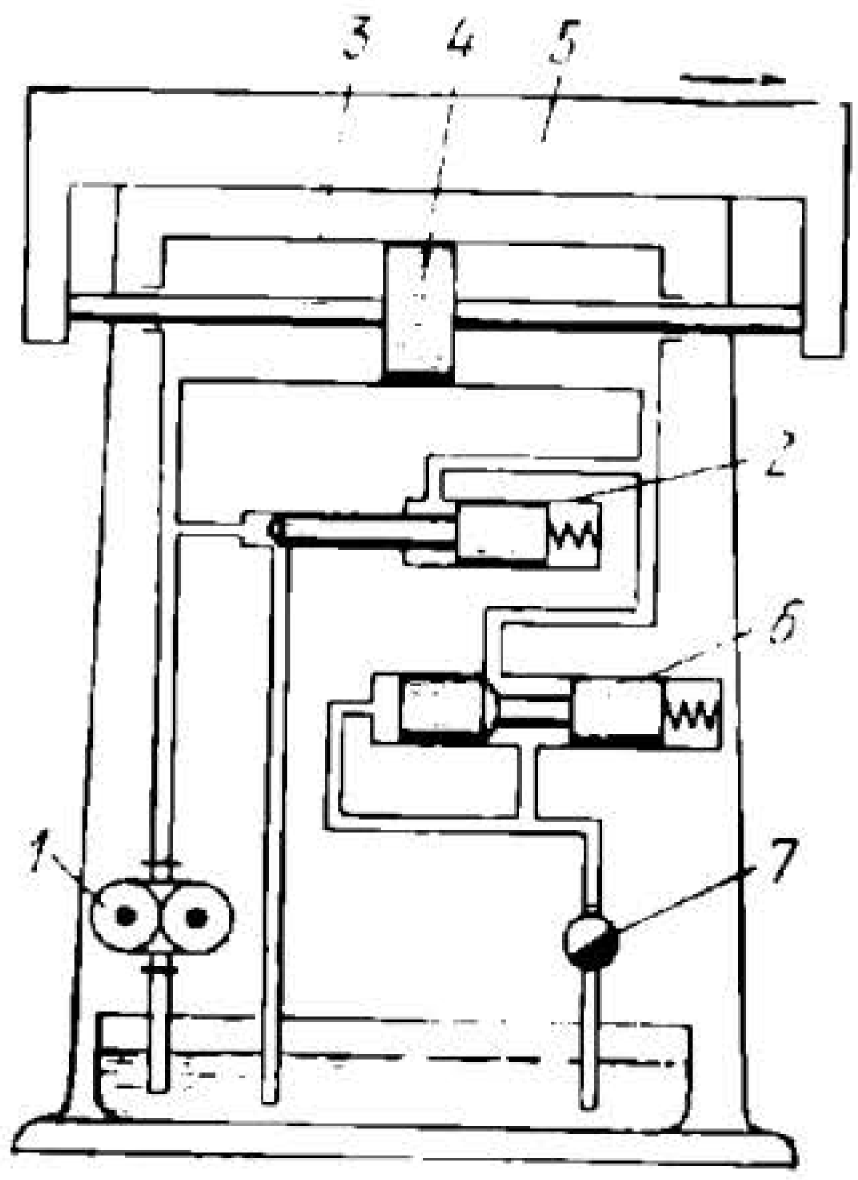
Gear pump *1* delivers fluid to the rod end of cylinder *2* and to the suction chamber of variable-displacement rotary piston pump *3*. Valve member *4* is subject on top to the pressure developed by piston pump *3* and below to the pressure developed by gear pump *1*. Since the top and bottom cross-sectional areas of valve member *4* are equal, the discharge and suction chambers of pump *3* are at the same pressure, and this eliminates leakage from one chamber to the other. Surplus fluid delivered by pump *1* drains back to the tank through relief valve *6*. Relief valve *5* protects the system against overloads.

4143	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



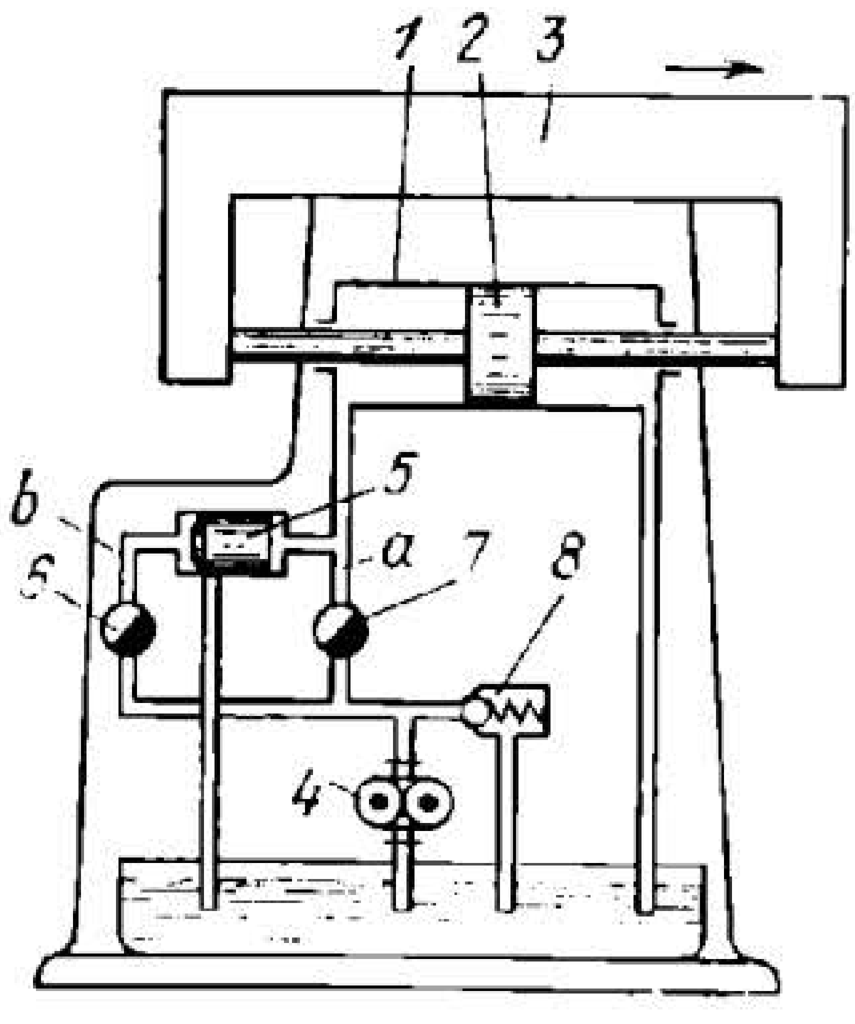
Pump *1* delivers fluid at constant pressure, regulated by relief valve *2*, to the left end of cylinder *3*, and piston *4*, together with machine tool table *5*, travels to the right. Fluid exhausted from the right end of cylinder *3* passes through pressure reducing valve *6* and flow-control valve *7*. Reducing valve *6* maintains constant fluid pressure before flow-control valve *7*. Flow-control valve *7* regulates the pressure in the right end of cylinder *3* so that piston *4* and table *5* travel at the required speed. When flow-control valve *7* is closed to some extent, table *5* and piston *4* travel at lower speed. At this, a part of the fluid delivered by pump *1* is drained through relief valve *2* back to the tank. As valve *7* is opened, table *5* and piston *4* travel at a higher speed.

4144	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



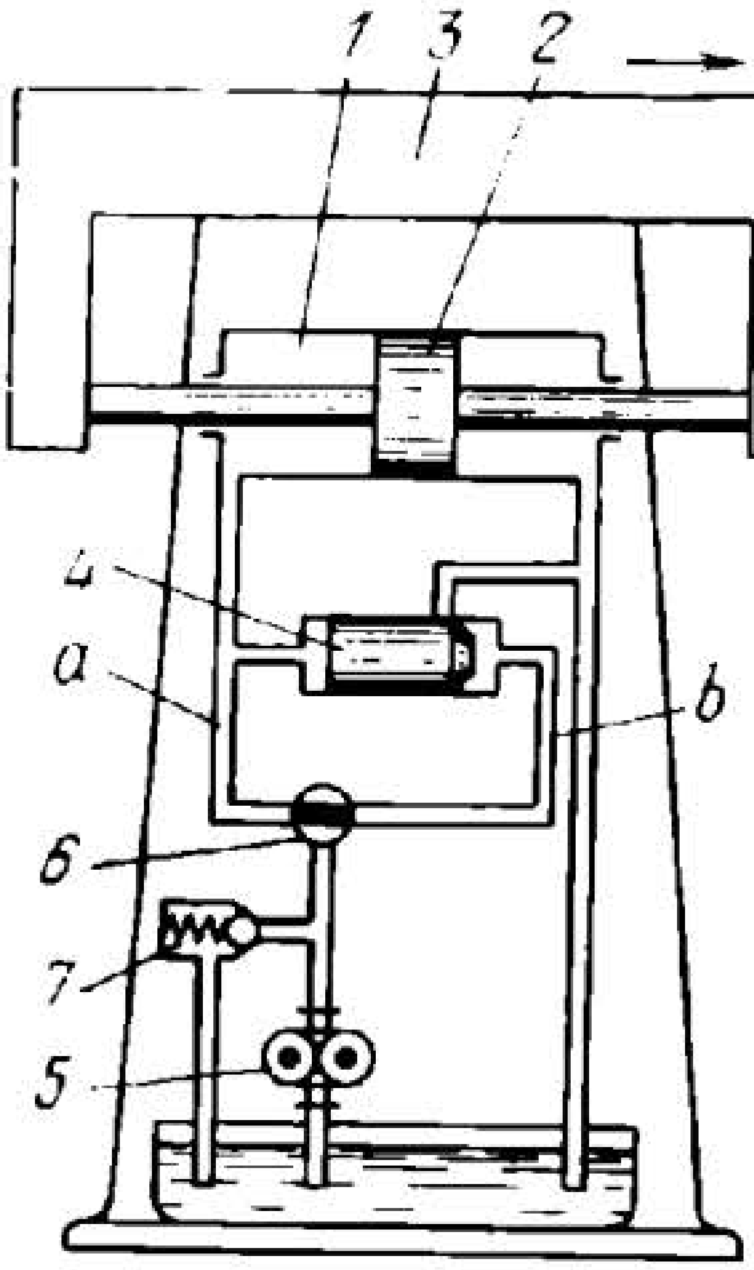
Gear pump *1* delivers fluid at constant pressure to the left end of cylinder *3*, and piston *4*, together with machine tool table *5*, travels to the right. Fluid discharged from the right end of cylinder *3* passes through pressure reducing valve *6* and flow-control valve *7*. Reducing valve *6* maintains constant fluid pressure before flow-control valve *7*. The pressure in the right end of cylinder *3* is set up by means of valve *7* to obtain the required speed of piston *4* and table *5*. As flow-control valve *7* is closed, the pressure of the fluid in the system increases. This shifts valve member *2* to the right, compressing the spring, and a part of the fluid delivered by pump *1* drains back to the tank.

4145	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



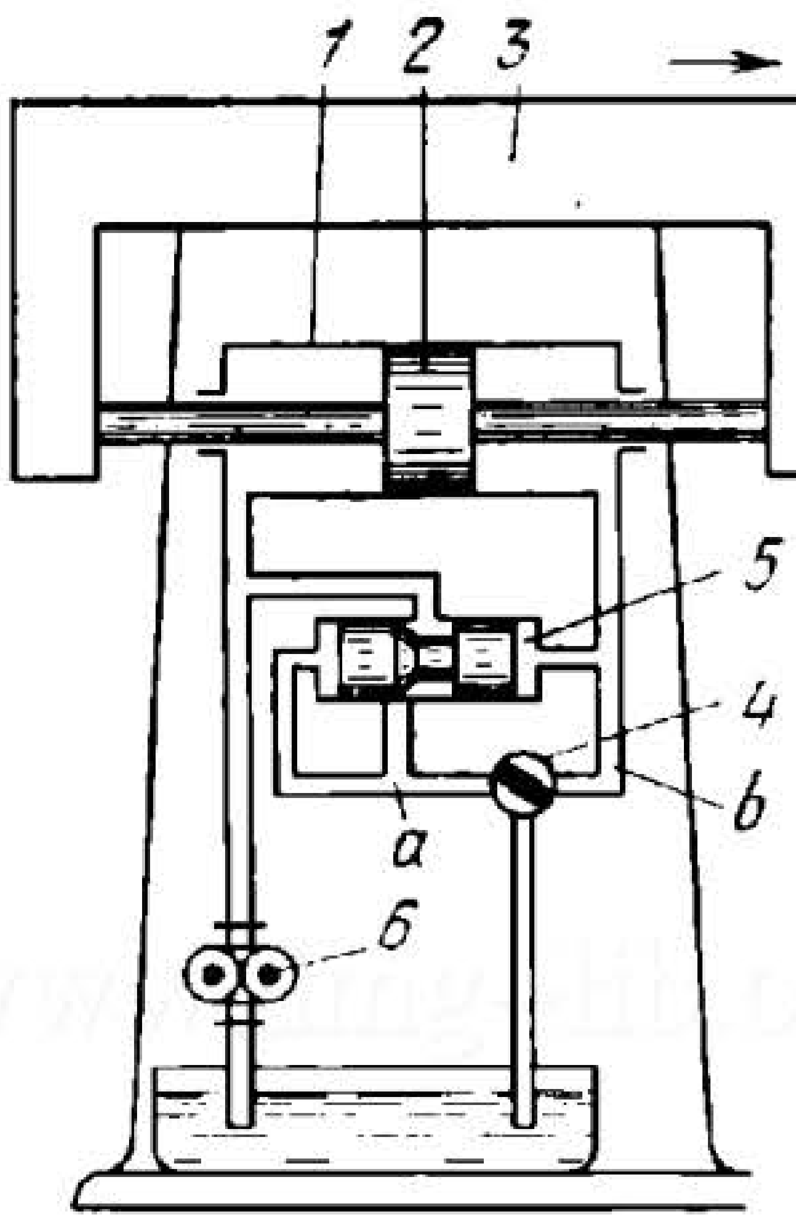
Gear pump *4* delivers fluid at constant pressure to the left end of cylinder *1*, and piston *2*, together with machine tool table *3*, travels to the right. If flow-control valve *7* of pipeline *a* is fully open and flow-control valve *6* of pipeline *b* is closed, the total output of pump *4* is delivered to cylinder *1* and table *3* travels at maximum speed. If valve *7* is closed and valve *6* is open, valve spool *5* is shifted to the right, the whole output of pump *4* is discharged to the tank and table *3* stops. Thus, by adjusting flow-control valves *6* and *7*, it is possible to regulate the amount of fluid delivered to cylinder *1* and, consequently, the speed of travel of table *3*. Surplus fluid is discharged back to the tank through relief valve *8*.

4146	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



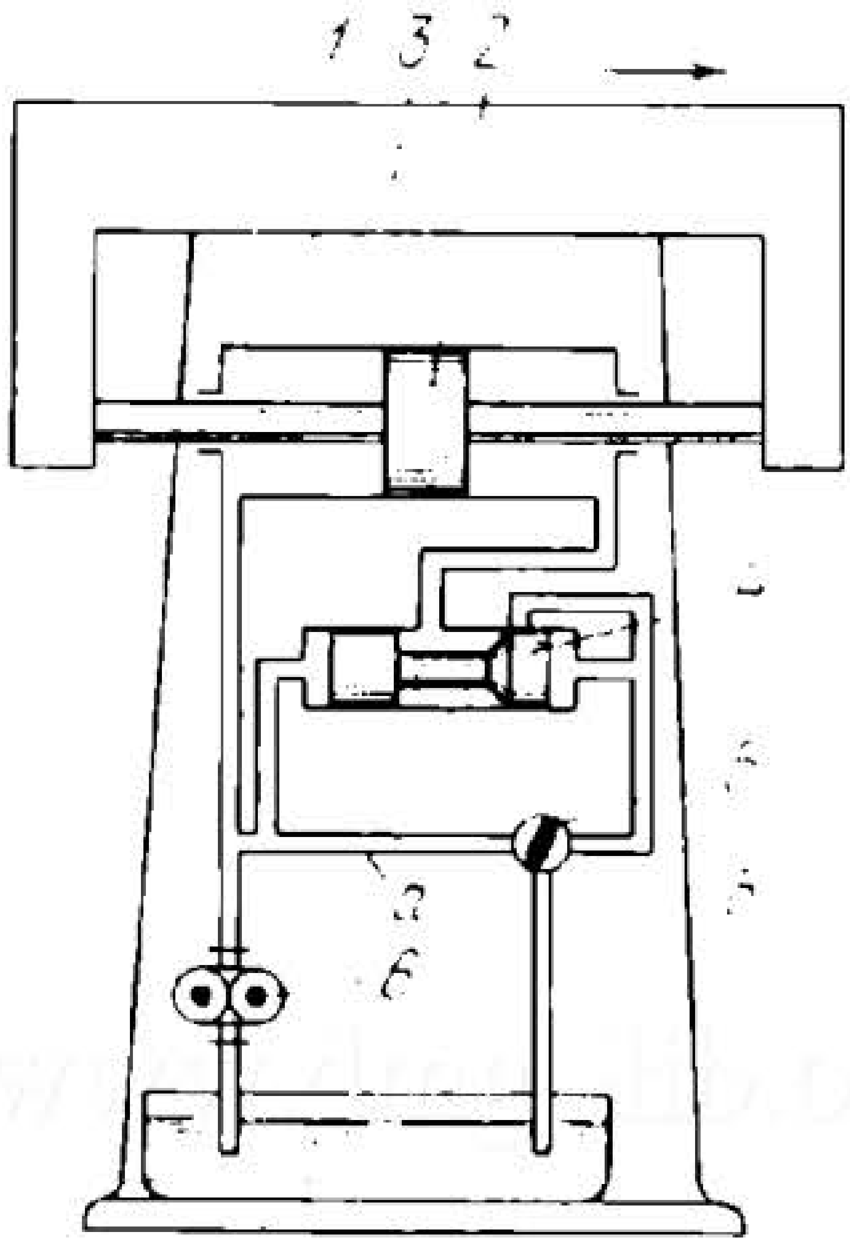
Gear pump 5 delivers fluid at constant pressure through rotary valve 6 to the left end of cylinder 1, and piston 2, together with machine tool table 3, travels to the right. If valve 6 is positioned so that pipeline *a* is open and pipeline *b* is closed, table 3 travels at maximum speed, valve spool 4 is shifted to the right by the pressure of the fluid, and the fluid exhausted from the right end of cylinder 1 drains back to the tank. If valve 6 is positioned so that pipeline *a* is closed and pipeline *b* is open, the fluid delivered by the pump shifts valve spool 4 to the left and is discharged to the tank. At this, table 3 stops. Thus, by changing the position of valve 6, it is possible to regulate the amount of fluid delivered to cylinder 1 and, consequently, the speed of travel of table 3. Surplus fluid is discharged from the system back to the tank by relief valve 7.

4147	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



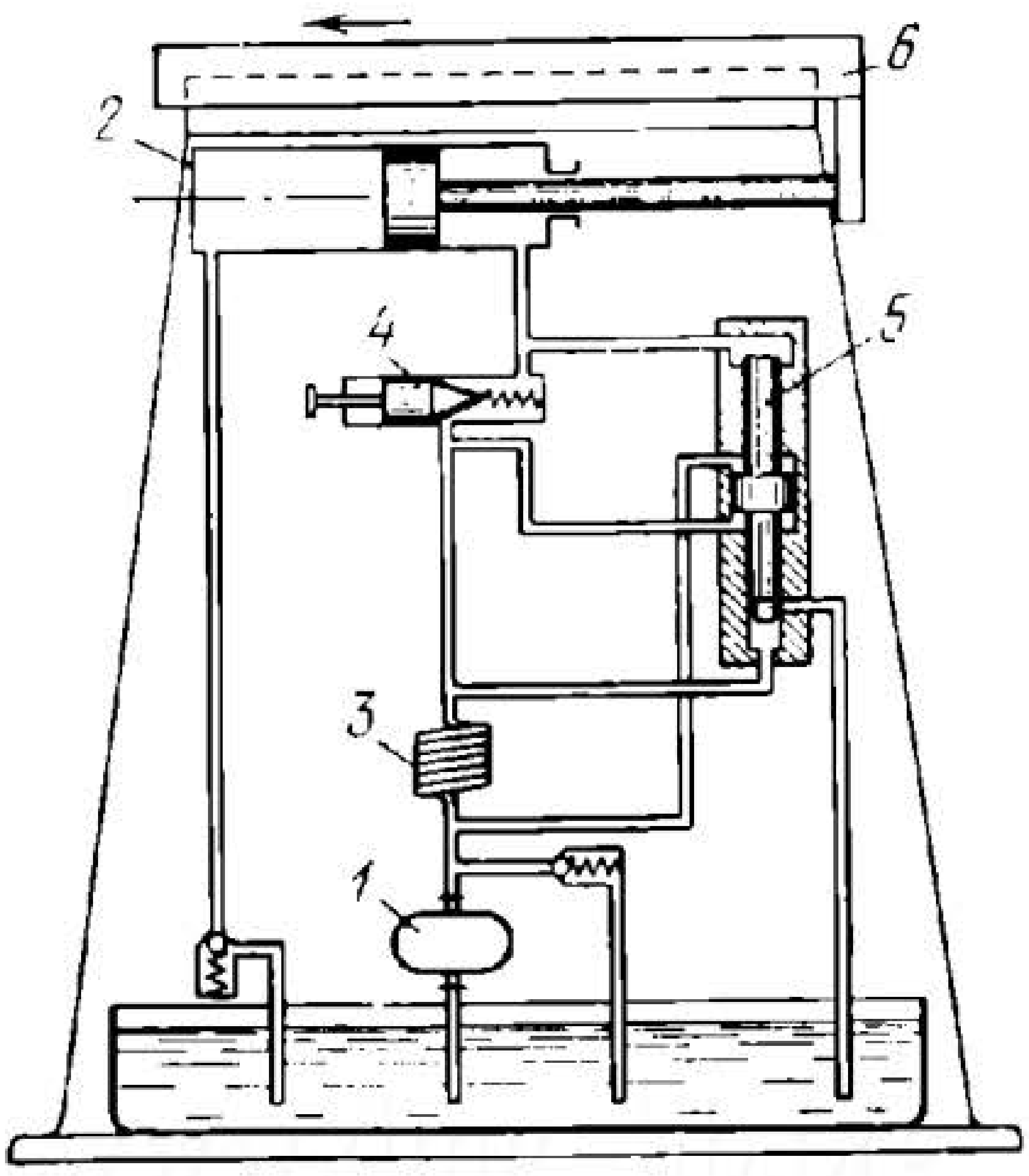
Gear pump *6* delivers fluid at constant pressure to the left end of cylinder *1*, and piston *2*, together with machine tool table *3*, travels to the right. Fluid exhausted from the right end of cylinder *1* passes to rotary valve *4* and to valve spool *5*. If valve *4* is positioned so that pipeline *a* is closed and pipeline *b* is open, the discharged fluid drains to the tank and table *3* travels at maximum speed. If valve *4* is positioned so that pipeline *a* is open and pipeline *b* is closed, valve spool *5* is shifted to the left by the pressure of the fluid, and the fluid delivered by pump *6* is discharged back to the tank. At this, table *3* stops. Thus, by changing the position of valve *4*, it is possible to regulate the amount of fluid delivered to cylinder *1* and, consequently, the speed of travel of table *3*.

4148	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



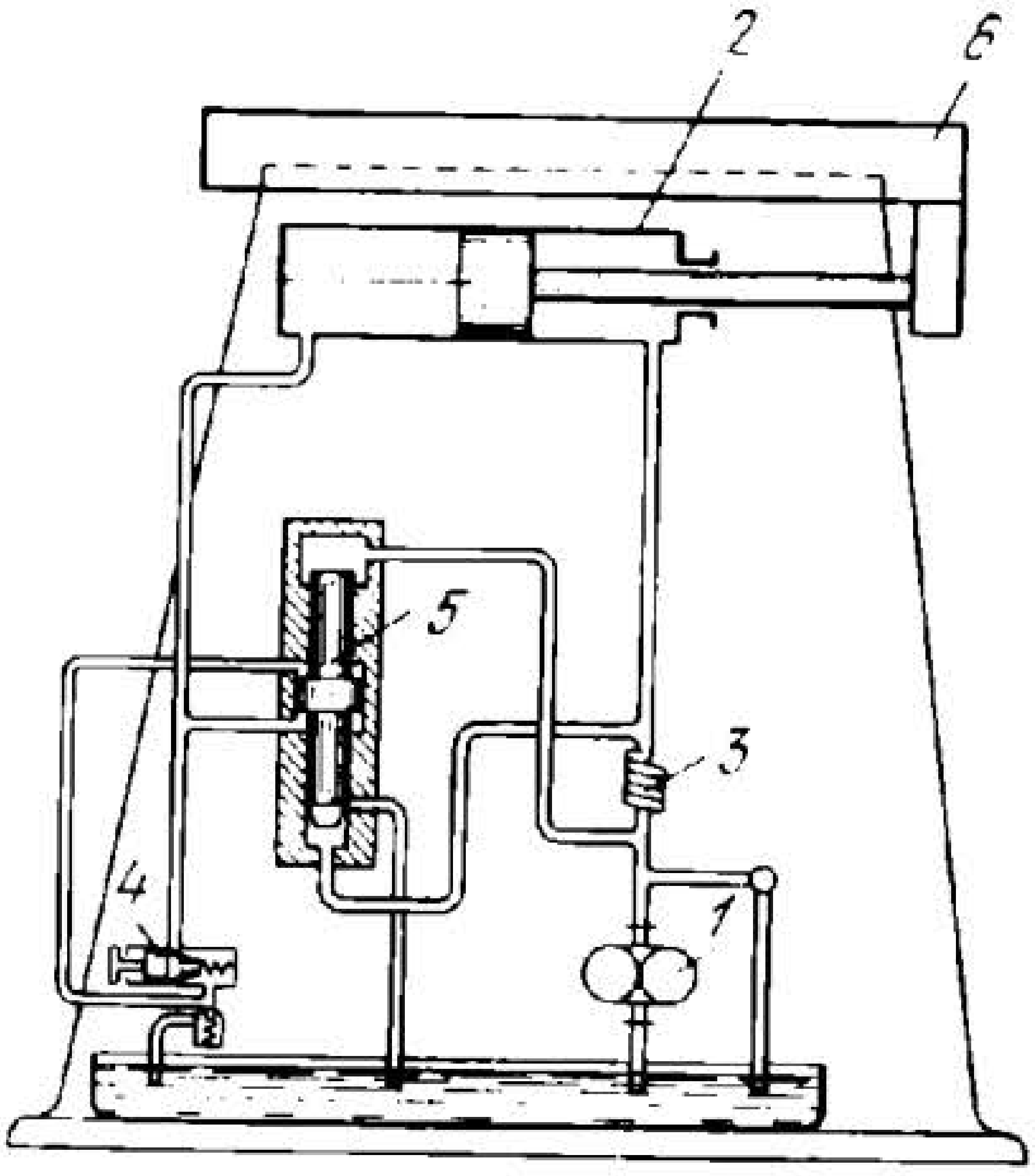
Gear pump *6* delivers fluid at constant pressure to the left end of cylinder *1*, and piston *2*, together with table *3*, travels to the right. Fluid exhausted from the right end of cylinder *1* passes through a groove of valve spool *4* to rotary valve *5*. If valve *5* is positioned so that pipeline *a* is closed and pipeline *b* is open, valve spool *4* is shifted to the right by the pressure of the fluid and the fluid discharged from cylinder *1* drains to the tank. At this, table *3* travels at maximum speed. If valve *5* is positioned so that pipeline *a* is open and pipeline *b* is closed, valve spool *4* is shifted to the left by the pressure of the fluid, and the fluid delivered by pump *6* is discharged back to the tank. At this, table *3* stops. Thus, by changing the position of valve *5*, it is possible to regulate the amount of fluid delivered to cylinder *1* and, consequently, the speed of travel of table *3*.

4149	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AN AUTOMATIC VALVE	CHP Dr



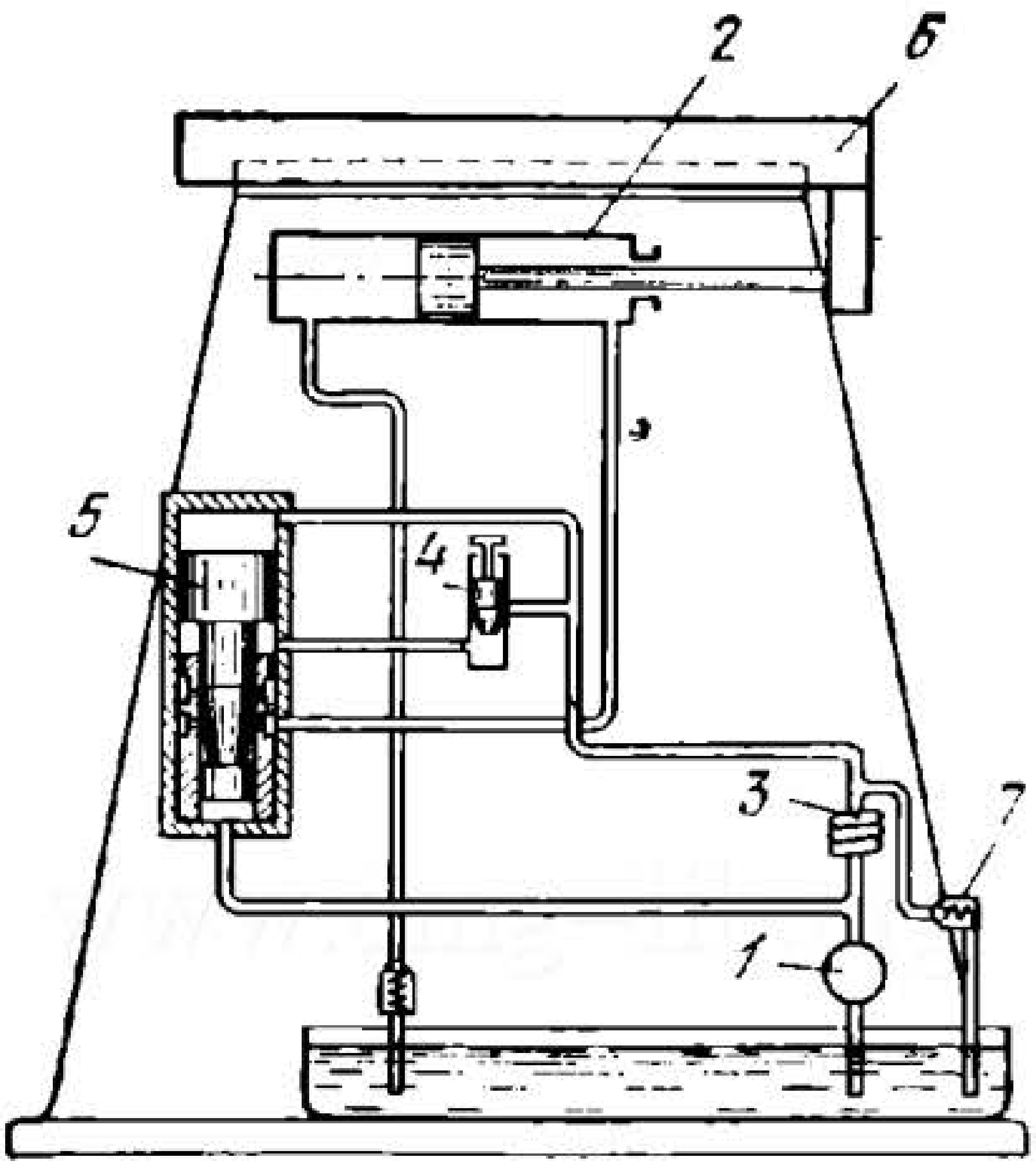
Gear pump *1* delivers fluid from the tank to power cylinder *2* through coil *3*, serving to compensate for the influence of the viscosity of the fluid, and flow-control valve *4*, serving to compensate for the variable working load of the machine tool. Flow-control valve *4* is set manually to obtain the required speed of travel of machine tool table *6*. Valve spool *5* is automatically controlled by fluid from branch lines of the main delivery pipeline. Coil *3* passes the total volume of fluid and it can be assumed that the pressure drop over the coil depends only on the viscosity of the fluid. Upon an increase in viscosity the pressure drop increases, valve spool *5* is shifted downward, blocking off fluid drain to the tank and thereby reducing the pressure drop over coil *3*. The working portion of the fluid, determining the speed of travel of table *6*, passes through flow-control valve *4*. If the working load on table *6* drops and the speed of the table begins to increase, valve spool *5* is shifted upward, increasing the discharge of fluid to the tank and stopping the increase in table speed. In case the fluid viscosity is reduced or the working load is increased, valve spool *5* is automatically shifted upward or downward, respectively.

4150	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AN AUTOMATIC VALVE	CHP Dr



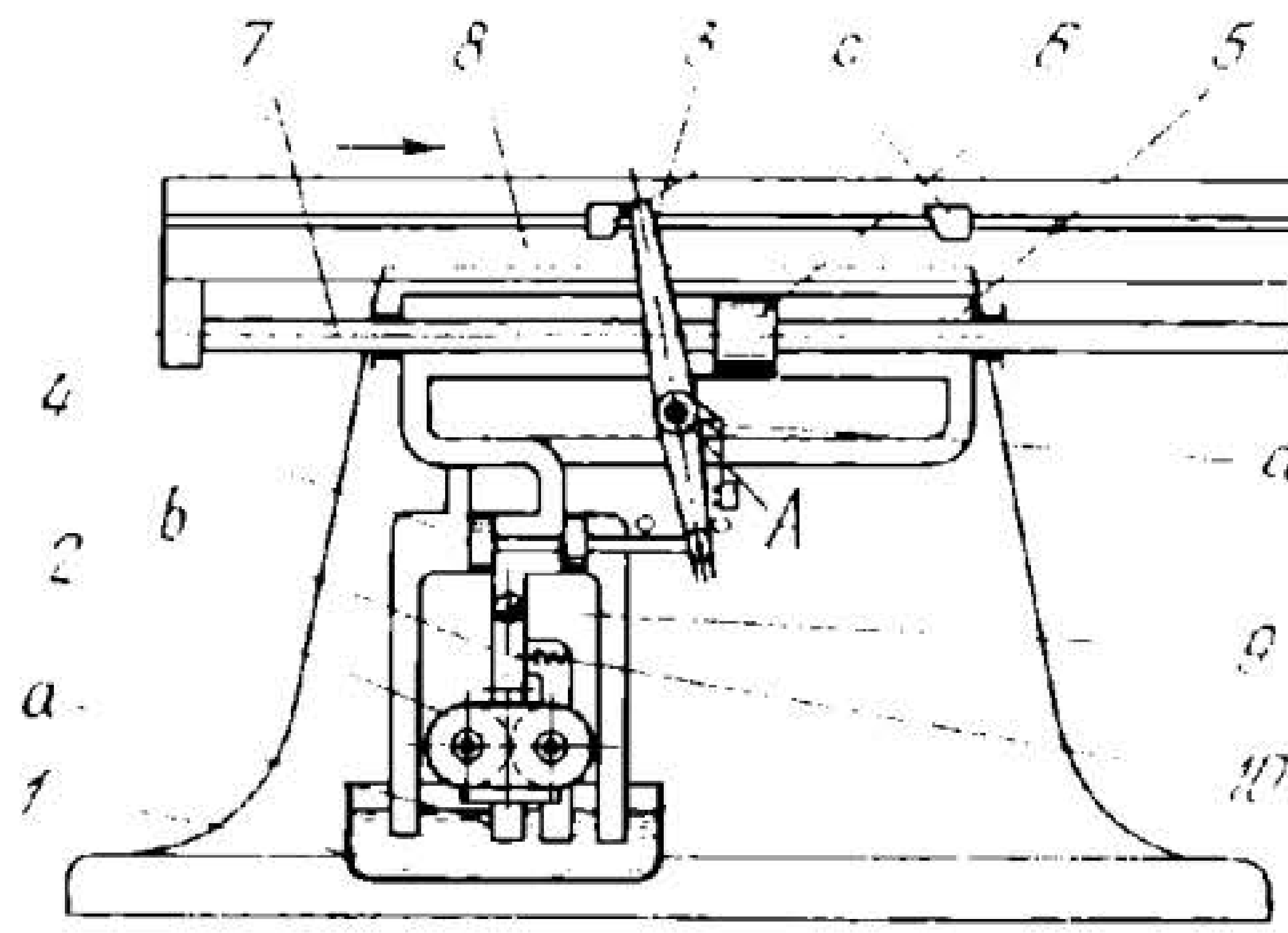
Gear pump *1* delivers fluid from the tank to power cylinder *2* through coil *3*, serving to compensate for the influence of the viscosity of the fluid. Flow-control valve *4*, serving to compensate for the variable working load of the machine tool, is mounted in the discharge pipeline, providing for more uniform feed of machine tool table *6*. Valve spool *5* is automatically controlled by fluid from branch lines connecting the valve body with the delivery and discharge pipelines. Coil *3* passes the total volume of fluid and it can be assumed that the pressure drop over the coil depends only on the viscosity of the fluid. Upon an increase in viscosity the pressure drop increases, valve spool *5* is shifted downward, blocking off fluid drain to the tank and thereby reducing the pressure drop over coil *3*. If the working load on table *6* drops and the speed of the table begins to increase, valve spool *5* is shifted upward, increasing the discharge of fluid to the tank and stopping the increase in table speed. In case the fluid viscosity is reduced or the working load is increased, valve spool *5* is automatically shifted in the directions opposite to those mentioned above.

4151	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH DOUBLE FLOW CONTROL	CHP Dr



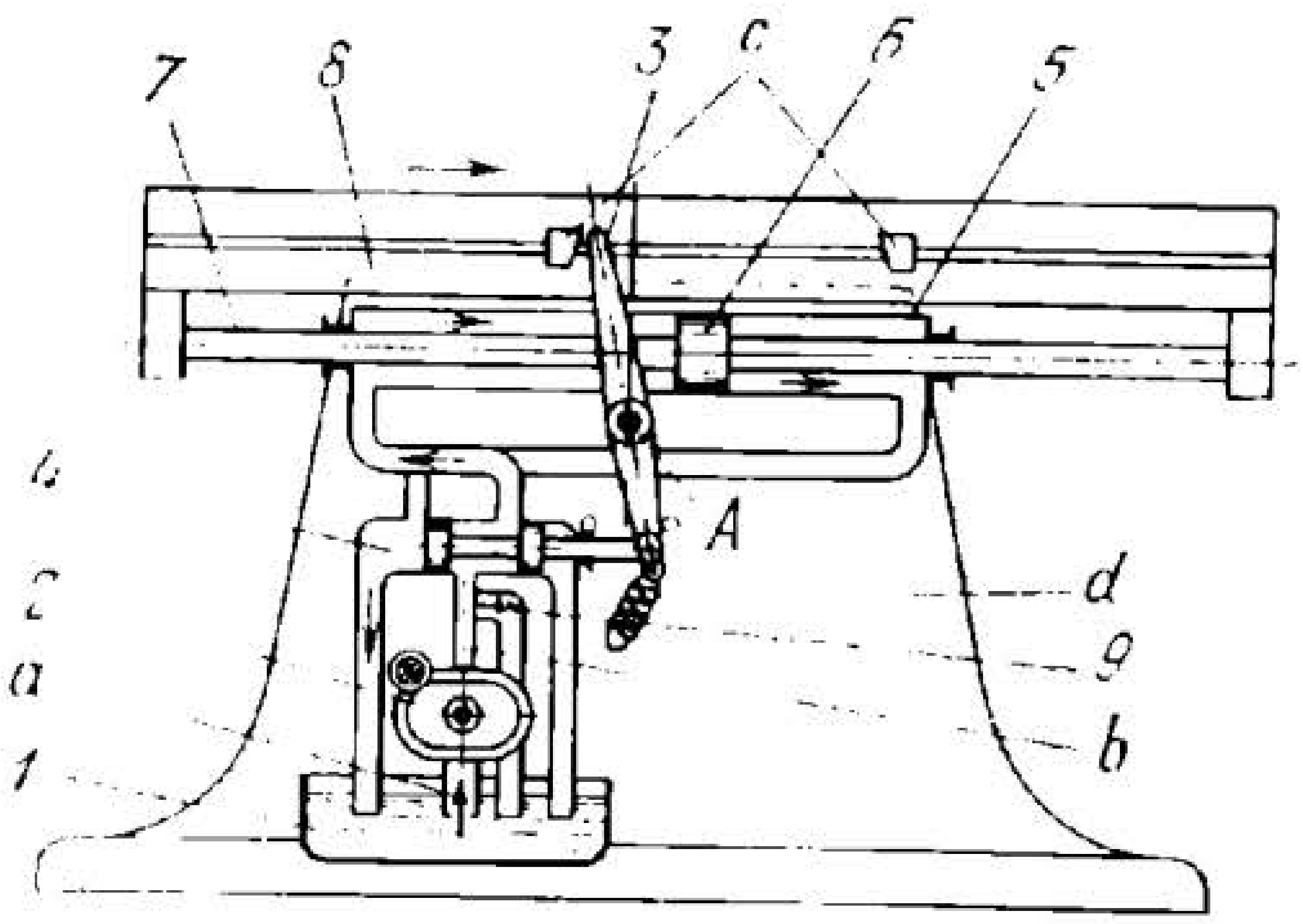
Pump 1 delivers fluid from the tank to power cylinder 2 through coil 3, serving to compensate for the influence of the viscosity of the fluid, and through manual flow-control valve 4, serving to compensate for the variable working load of the machine tool. In case of a change in the pressure drop over coil 3, valve spool 5 is shifted to automatically change the hydraulic resistance in the delivery pipeline, compensating for the change in fluid viscosity and working load on table 6. Surplus fluid is discharged from the system back to the tank by relief valve 7.

4152	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AUTOMATIC REVERSAL AND A CONSTANT-DISPLACEMENT PUMP	CHP Dr



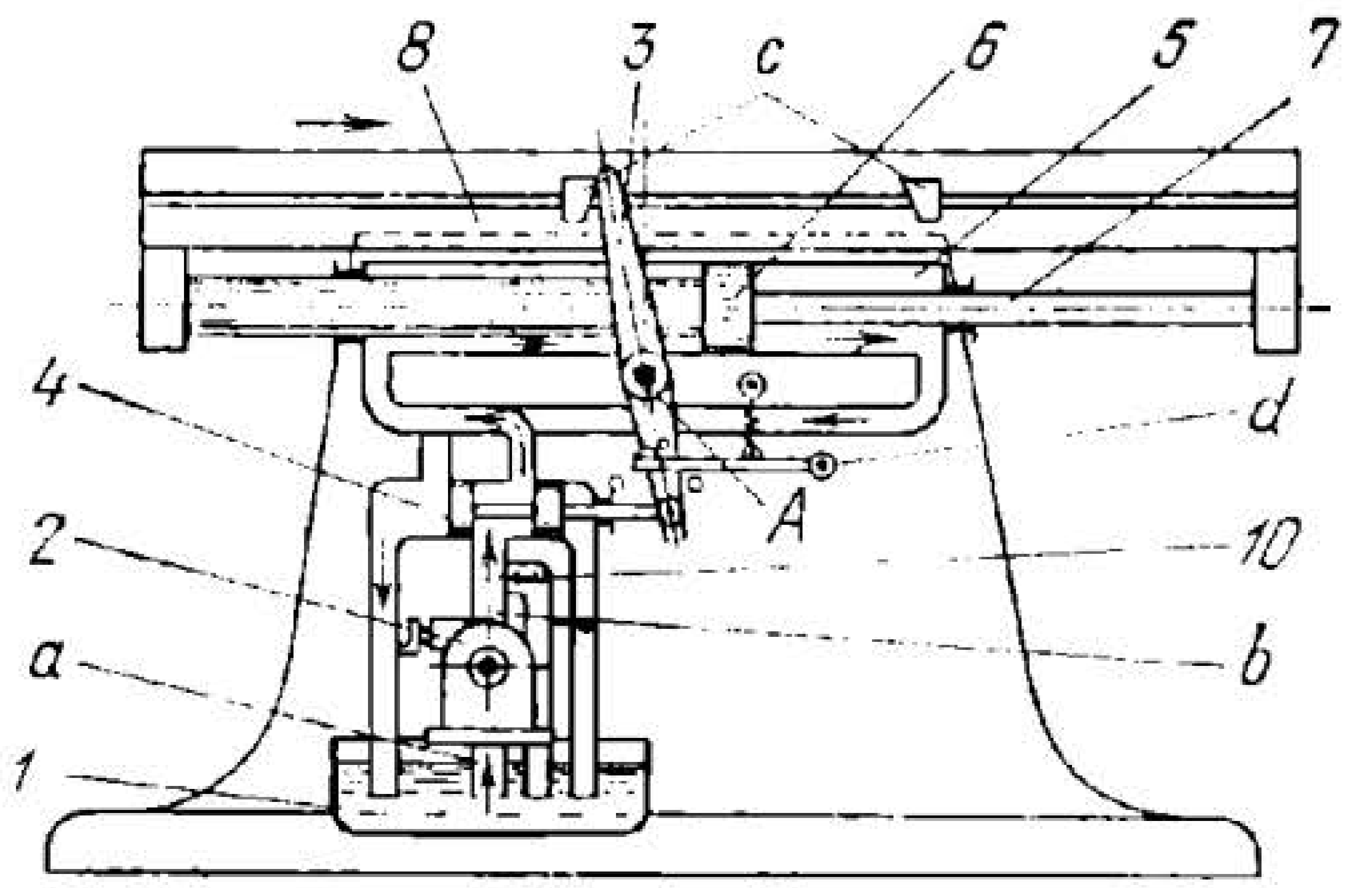
Fluid is drawn in from tank *1* through suction pipe *a* to hydraulic pump *2* from where it enters delivery pipeline *b*. In the left-hand position (as shown) of lever *3*, turning about fixed axis *A*, fluid from the delivery pipeline passes through valve *4* to the left end of cylinder *5*, moving piston *6*, piston rod *7* and table *8*, attached to the piston rod, to the right. From the right end of cylinder *5*, fluid is discharged through valve *4* to tank *1*. In the right-hand position of lever *3*, fluid is delivered to the right end of cylinder *5*, moving table *8* to the left. In this case, fluid from the left end of cylinder *5* is discharged through valve *4* to tank *1*. Lever *3* of valve *4* is turned by trip dogs *c* mounted on travelling machine tool table *8*. Catch *d* serves to eliminate uncertainty in the positions of lever *3*. Flow-control valve *9* regulates the amount of fluid delivered to cylinder *5* and, consequently, the speed of travel of table *8*. Surplus fluid is discharged back to tank *1* by relief valve *10*.

4153	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AUTOMATIC REVERSAL AND A VARIABLE-DISPLACEMENT PUMP	CHP Dr



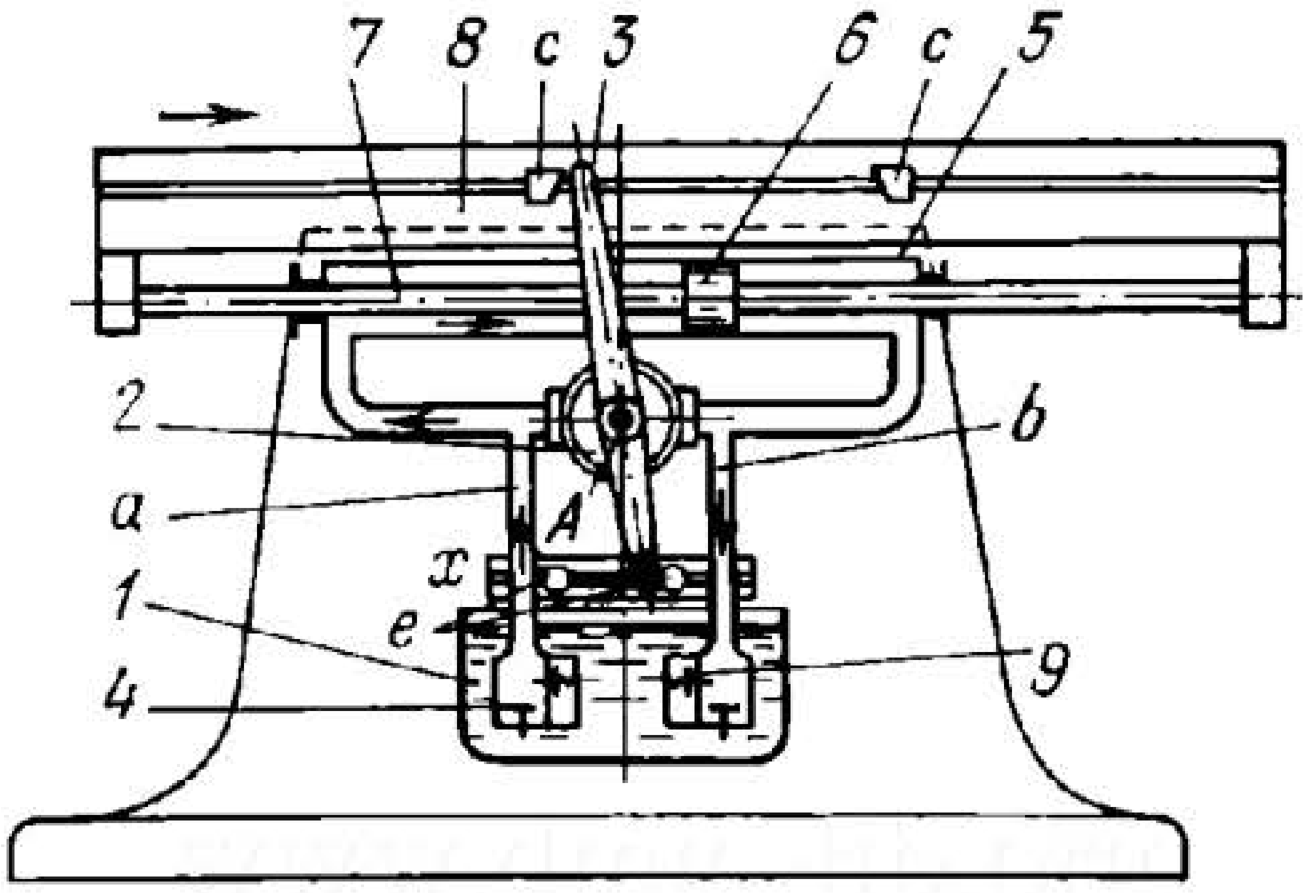
Fluid is drawn in from tank *1* through suction pipe *a* to hydraulic pump *2* from where it enters delivery pipeline *b*. In the left-hand position (as shown) of lever *3*, turning about fixed axis *A*, fluid from the delivery pipeline passes through valve *4* to the left end of cylinder *5*, moving piston *6*, piston rod *7* and table *8*, attached to the piston rod, to the right. From the right end of cylinder *5*, fluid is discharged through valve *4* to tank *1*. In the right-hand position of lever *3*, fluid is delivered to the right end of cylinder *5*, moving table *8* to the left. In this case, fluid from the left end of cylinder *5* is discharged through valve *4* to tank *1*. Lever *3* of valve *4* is turned by trip dogs *c* mounted on travelling machine tool table *8*. Catch *d* serves to eliminate uncertainty in the positions of lever *3*. The amount of fluid delivered to cylinder *5* and, consequently, the speed of travel of table *8* is regulated by means of the pump. Surplus fluid is discharged back to tank *1* through relief valve *9*.

4154	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH A VARIABLE-DISPLACEMENT PUMP AND DIFFERENT FORWARD AND RETURN SPEEDS OF TABLE TRAVEL	CHP Dr



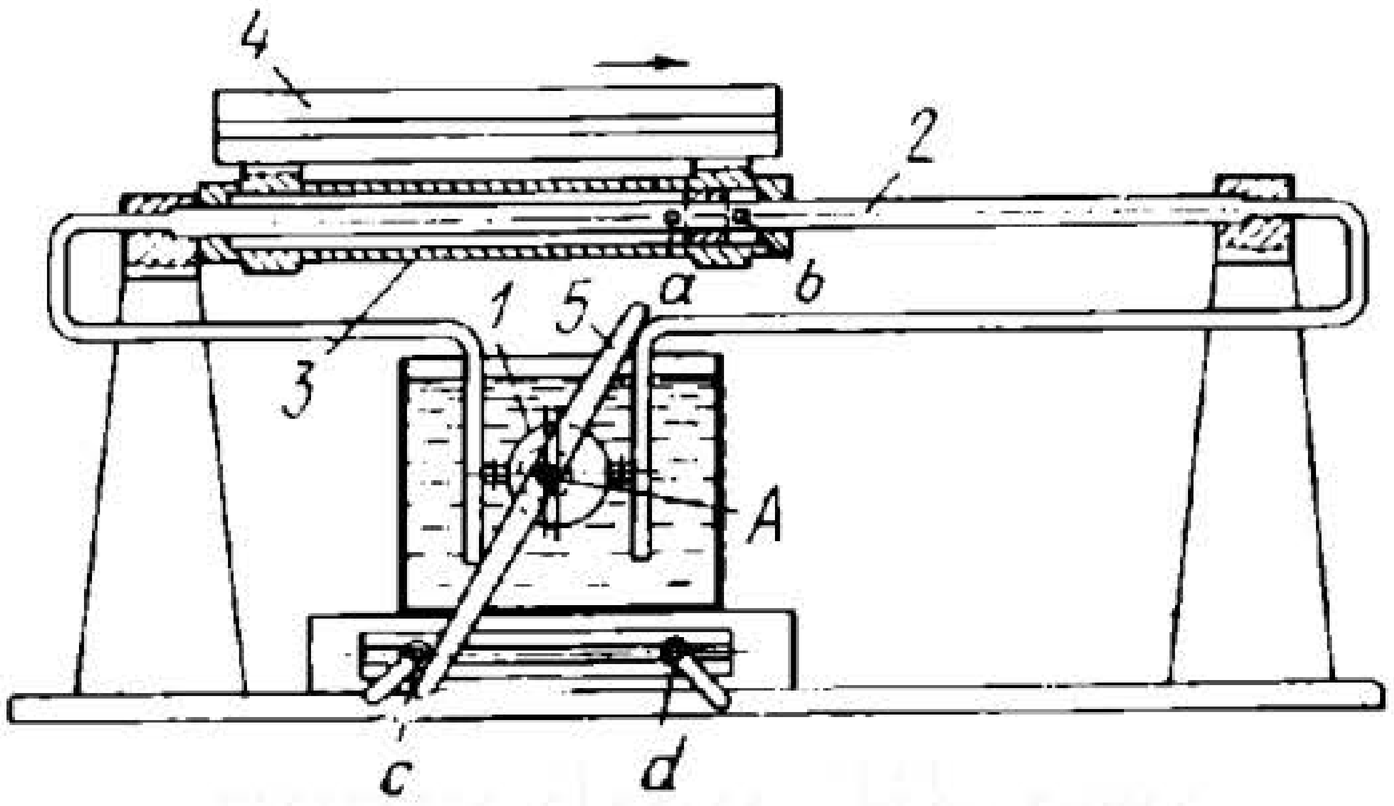
Fluid is drawn in from tank *1* through suction pipe *a* to hydraulic pump *2* from where it enters delivery pipeline *b*. In the left-hand position (as shown) of lever *3*, turning about fixed axis *A*, fluid from the delivery pipeline passes through valve *4* to the left end of cylinder *5*, moving piston *6*, piston rod *7* and table *8*, attached to the piston rod, to the right. From the right end of cylinder *5*, fluid is discharged through valve *4* to tank *1*. In the right-hand position of lever *3*, fluid is delivered to the right end of cylinder *5*, moving table *8* to the left. In this case, fluid from the left end of cylinder *5* is discharged through valve *4* to tank *1*. Lever *3* of valve *4* is turned by trip dogs *c* mounted on travelling machine tool table *8*. Catch *d* serves to eliminate uncertainty in the positions of lever *3*. The amount of fluid delivered to cylinder *5* and, consequently, the speed of travel of table *8* is regulated by means of the pump. Surplus fluid is discharged back to tank *1* by relief valve *10*. Owing to the different diameters of the rod on the two ends of piston *6* and, therefore, different effective areas at the two ends, table *8* has different speeds on its forward and return strokes.

4155	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH A VARIABLE-DISPLACEMENT PUMP AND DIFFERENT FORWARD AND RETURN SPEEDS OF TABLE TRAVEL	CHP Dr



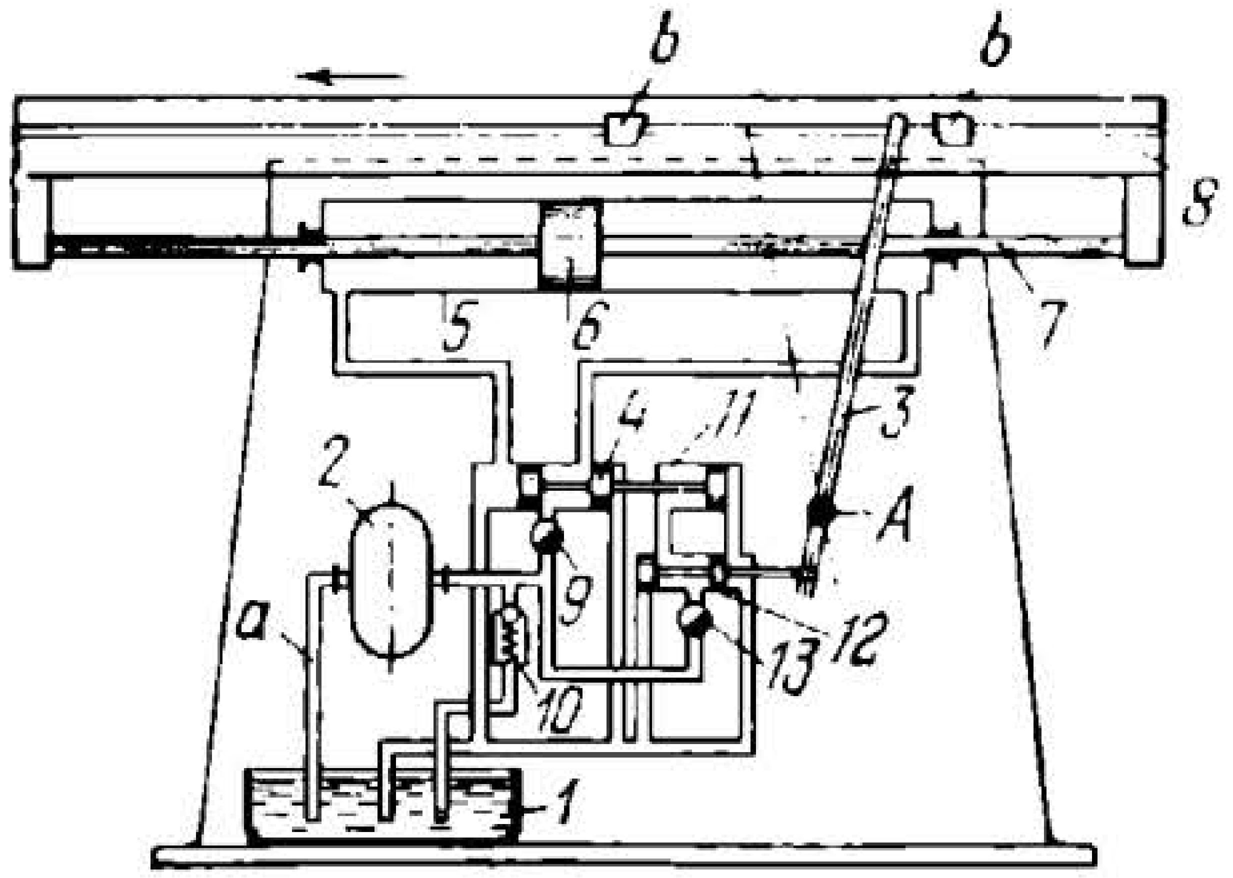
Fluid is drawn in from tank *1* through suction valve *4* and pipeline *a* to hydraulic pump *2*. In the left-hand position of lever *3*, turning about fixed axis *A*, pump *2* delivers fluid to the left end of cylinder *5*, moving piston *6*, piston rod *7* and table *8*, attached to the piston rod, to the right. From the right end of cylinder *5*, fluid is discharged through pipeline *b* to tank *1*. In the right-hand position of lever *3*, mounted directly on variable-displacement pump *2*, fluid is drawn in through pipeline *b* and is delivered to the right end of cylinder *5*, moving table *8* to the left. Lever *3* is turned by trip dogs *c* mounted on travelling machine tool table *8*. Different speeds for the forward and return strokes are set up by adjusting the positions of stops *e* along guide *x*. Surplus fluid is discharged back to tank *1* through relief valve *9*.

4156	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH A TRAVELLING CYLINDER	CHP Dr



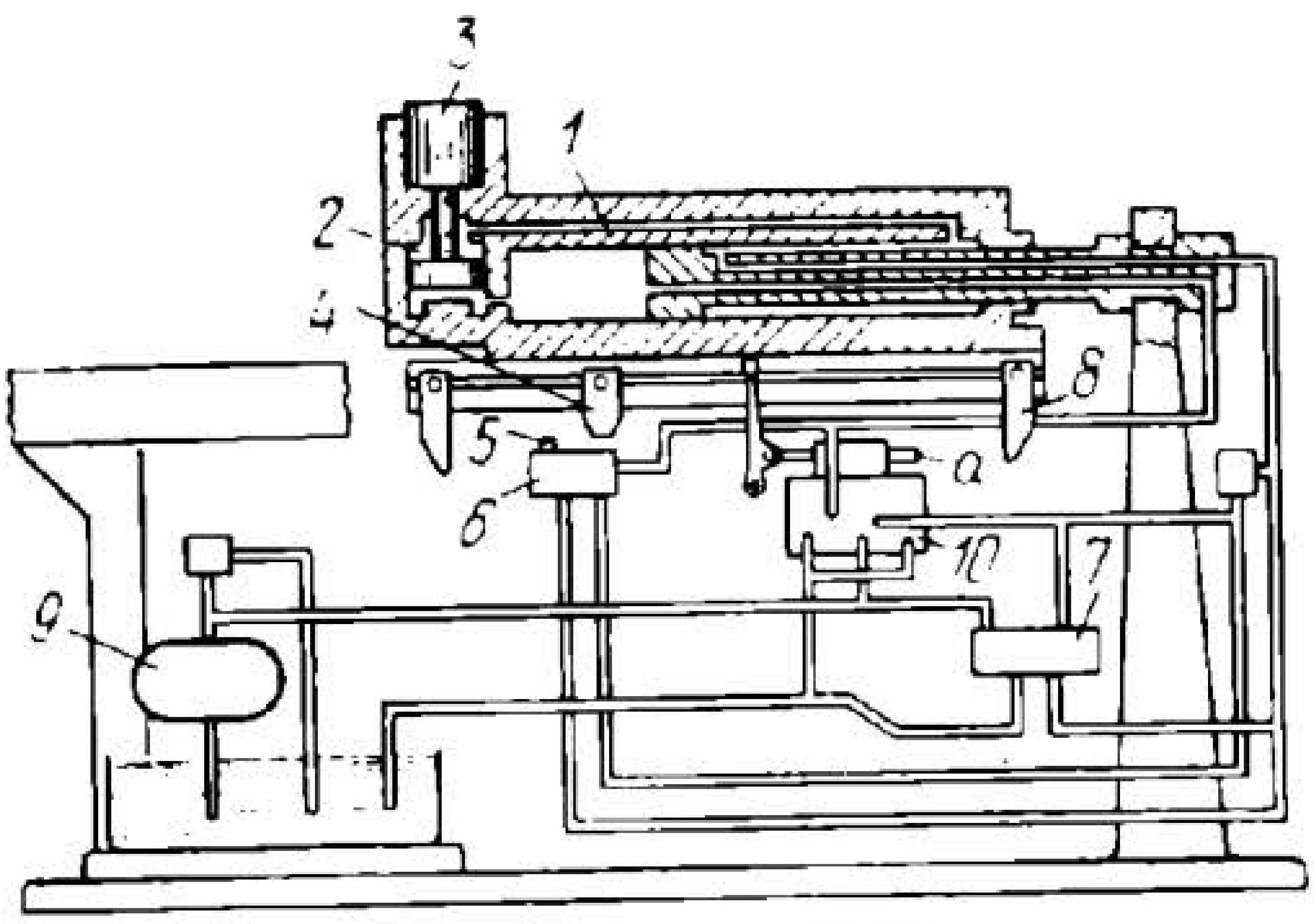
Fluid is delivered by variable-displacement pump *1* into hollow piston rod *2* and through port *b* to the right end of cylinder *3* which moves to the right together with table *4*. The table is reversed by lever *5*, turning about fixed axis *A*, and trip dogs *c* and *d*. After reversal, fluid is delivered through port *a* to the left end of cylinder *3*, moving it to the left.

4157	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AUTOMATIC REVERSAL	CHP Dr



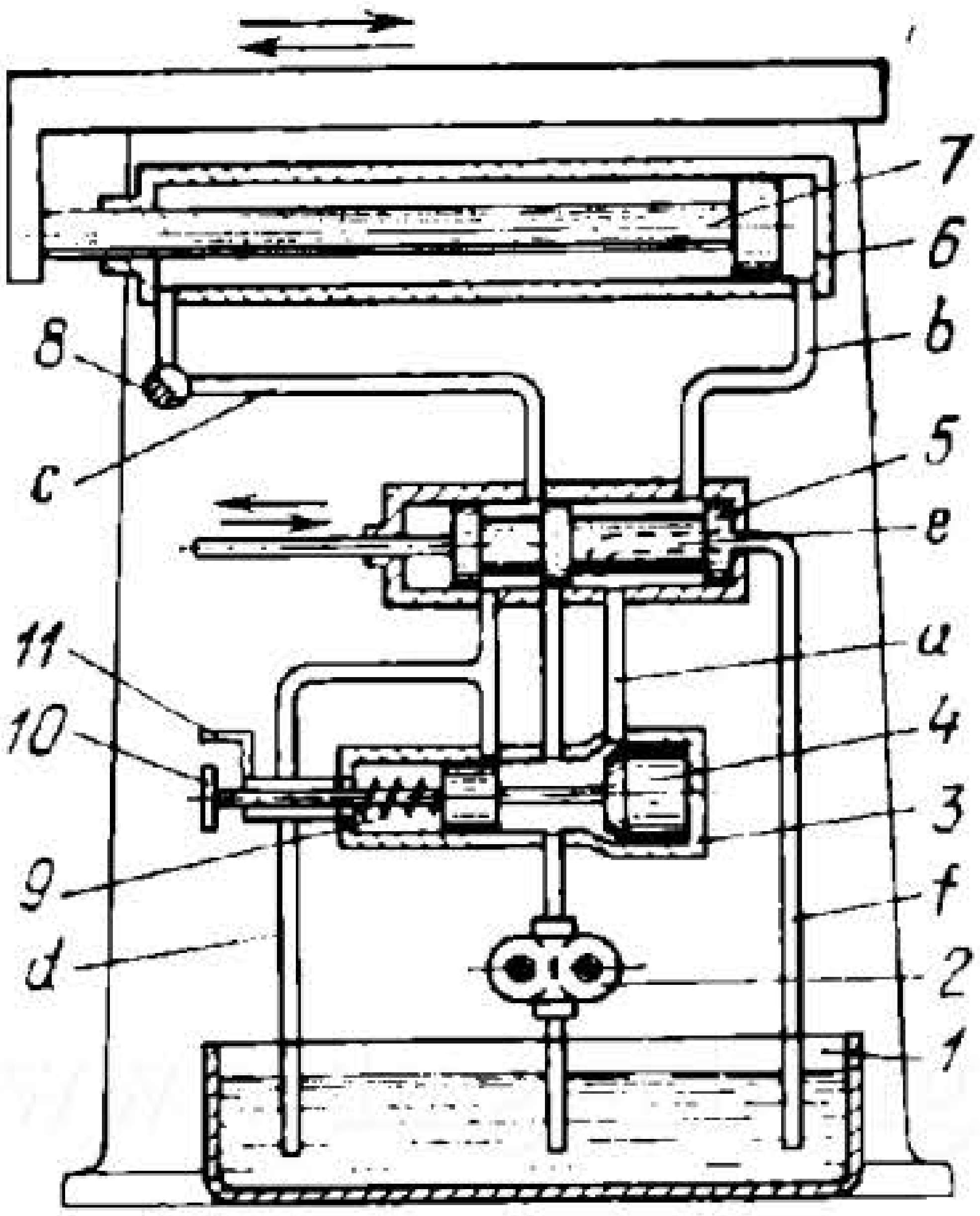
Fluid is drawn in from tank *1* through suction pipe *a* to hydraulic pump *2* from where it enters the delivery pipeline. In the right-hand position (as shown) of lever *3*, turning about fixed axis *A*, fluid from the delivery pipeline passes through directional valve *4* to the right end of cylinder *5*, moving piston *6*, piston rod *7* and table *8*, attached to the piston rod, to the left. From the left end of cylinder *5*, fluid is discharged through valve *4* to tank *1*. In the left-hand position of lever *3*, fluid is delivered to the left end of cylinder *5*, moving table *8* to the right. In this case, fluid from the right end of cylinder *5* is discharged through valve *4* to tank *1*. Lever *3* is turned by trip dogs *b* mounted on travelling machine tool table *8*. Flow-control valve *9* regulates the amount of fluid delivered to cylinder *5*. Surplus fluid is discharged back to tank *1* through relief valve *10*. Pilot valve *12* serves to control the motion of valve spool *11* and to eliminate uncertainty in the positions of lever *3*. The speed of the piston and table is set up by regulating flow-control valve *13*.

4158	HYDRAULIC DRIVE MECHANISM FOR A SHAPER RAM WITH DIFFERENT FORWARD AND RETURN SPEEDS	CHP Dr



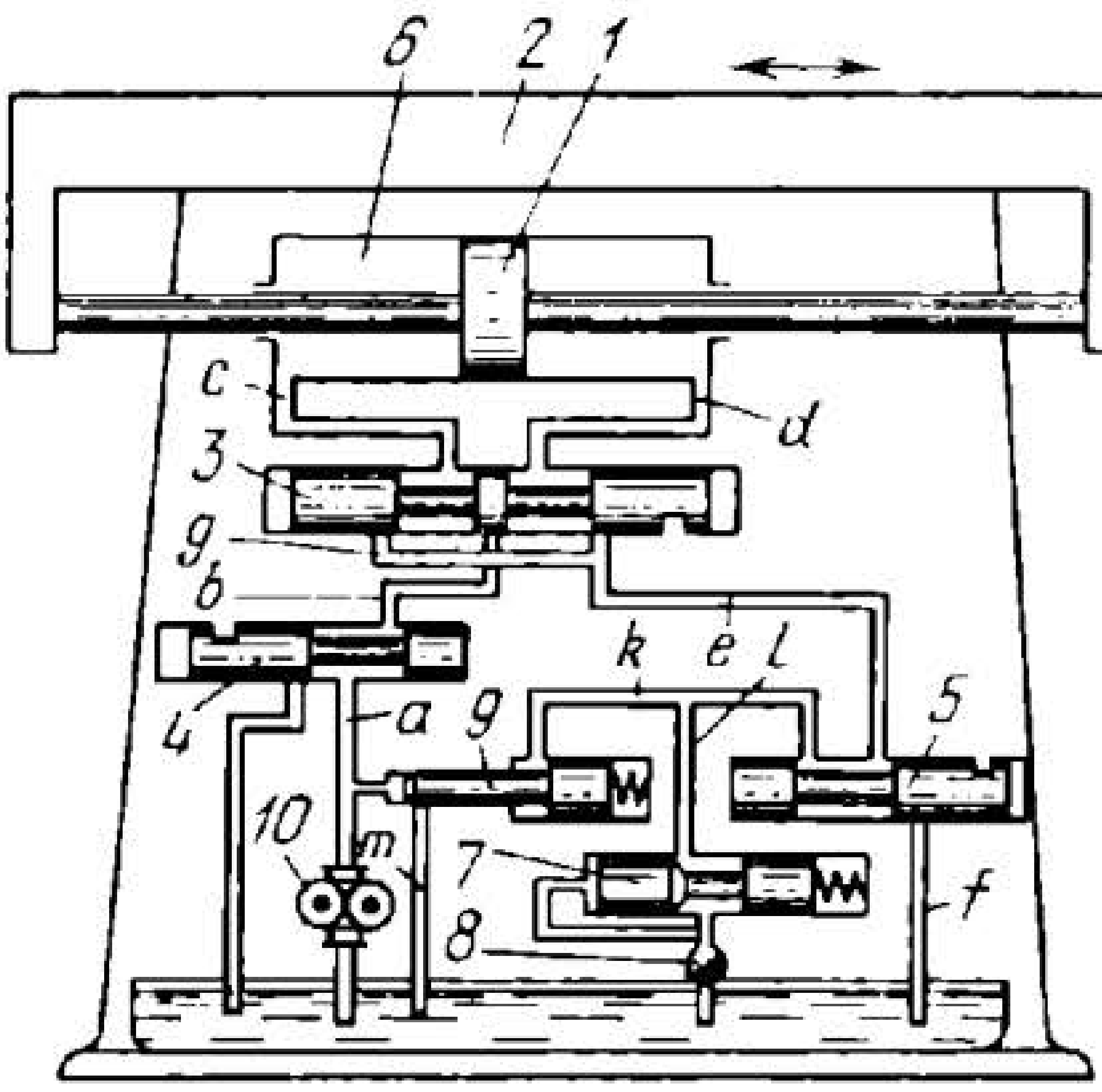
Cylinder *1*, attached to the travelling ram of the shaper is connected to cylinder *2* at the front end of the ram. Piston *3* of cylinder *2* is linked to the tool head of the shaper. The left end of cylinder *1* is connected to the lower end of cylinder *2*, and the right end of cylinder *1*, to the upper end of cylinder *2*. When fluid is delivered by pump *9* to the left end of cylinder *1*, piston *3* of cylinder *2* moves rapidly upward and advances the tool head to the workpiece being machined. When fluid is delivered to the right end of cylinder *1*, it flows to the upper end of cylinder *2* and rapidly retracts the tool head from the workpiece (on the return stroke of the ram). Until trip dog *4* reaches pin *5* of valve *6*, the ram has rapid traverse motion. At this point, valve *6* switches in speed regulator *7* and further travel of cylinder *1* and the ram is at a lower working speed. At the end of the working stroke, trip dog *8* presses pin *a* of reversing device *10* and switches on the rapid return stroke.

4159	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH DIFFERENT FORWARD AND RETURN SPEEDS	CHP Dr



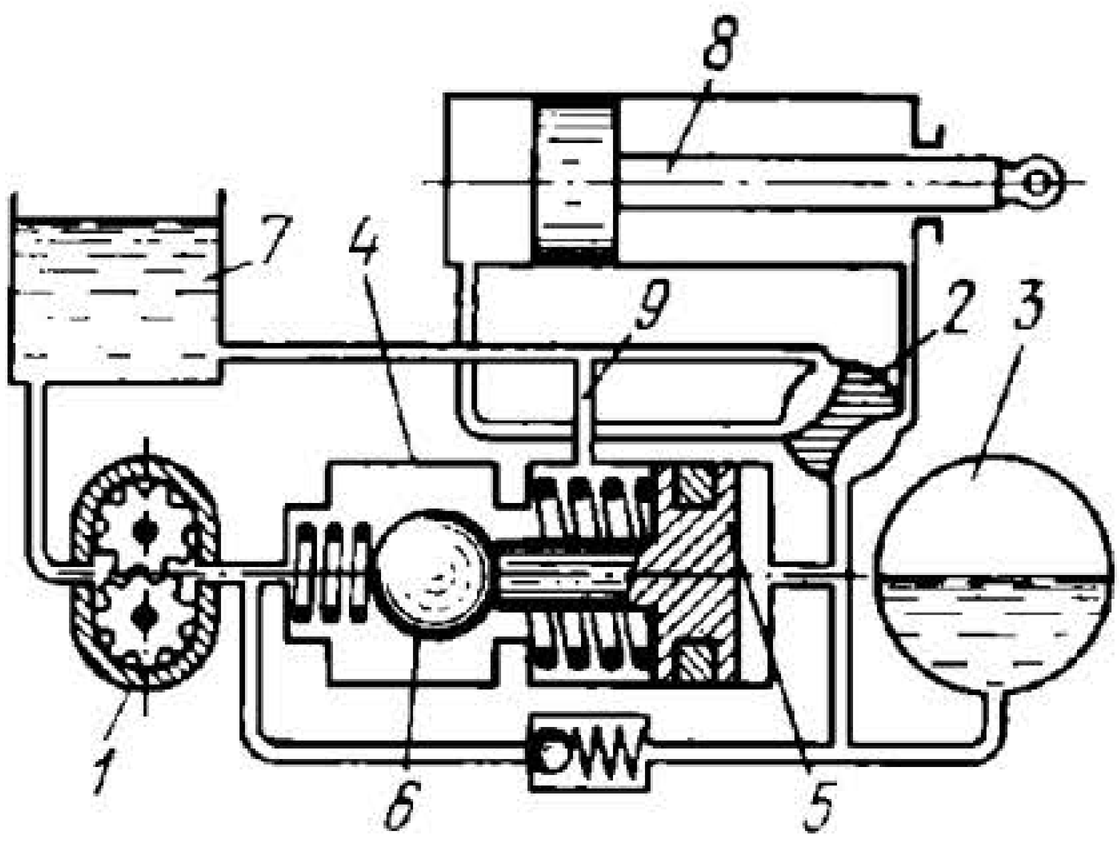
Fluid is delivered by pump *2* at constant pressure to directional valve *3* and further through flow-control valve *4* and valve *5*, along pipeline *b* to the right end of cylinder *6*. Piston 7, together with the machine tool table, moves to the left. From the left end of cylinder *6*, fluid is discharged through flow-control valve *8*, regulating the back pressure in cylinder *6*, along pipeline *c*, through valve *5* and along pipeline *d* to tank *1*. When the spool of valve *5* is shifted to the left, fluid is delivered through directional valve *3* and pipeline *a* to valve *5* and further, through open flow-control valve *8* to the left end of cylinder *6*. Piston *7* with the table travels at higher speed to the right because the volume (effective cross-sectional area) of the left end of the cylinder is less than that of the right end. Fluid discharged from the right end of cylinder *6* drains to tank *1* through pipelines *b* and *f*. Surplus fluid is discharged back to tank *1* through relief valve *9*. Handwheel *10* serves to regulate flow-control valve *4*, and handle *11* to regulate the force exerted by the spring of valve *9*.

4160	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH VARIABLE TRAVEL SPEEDS	CHP Dr



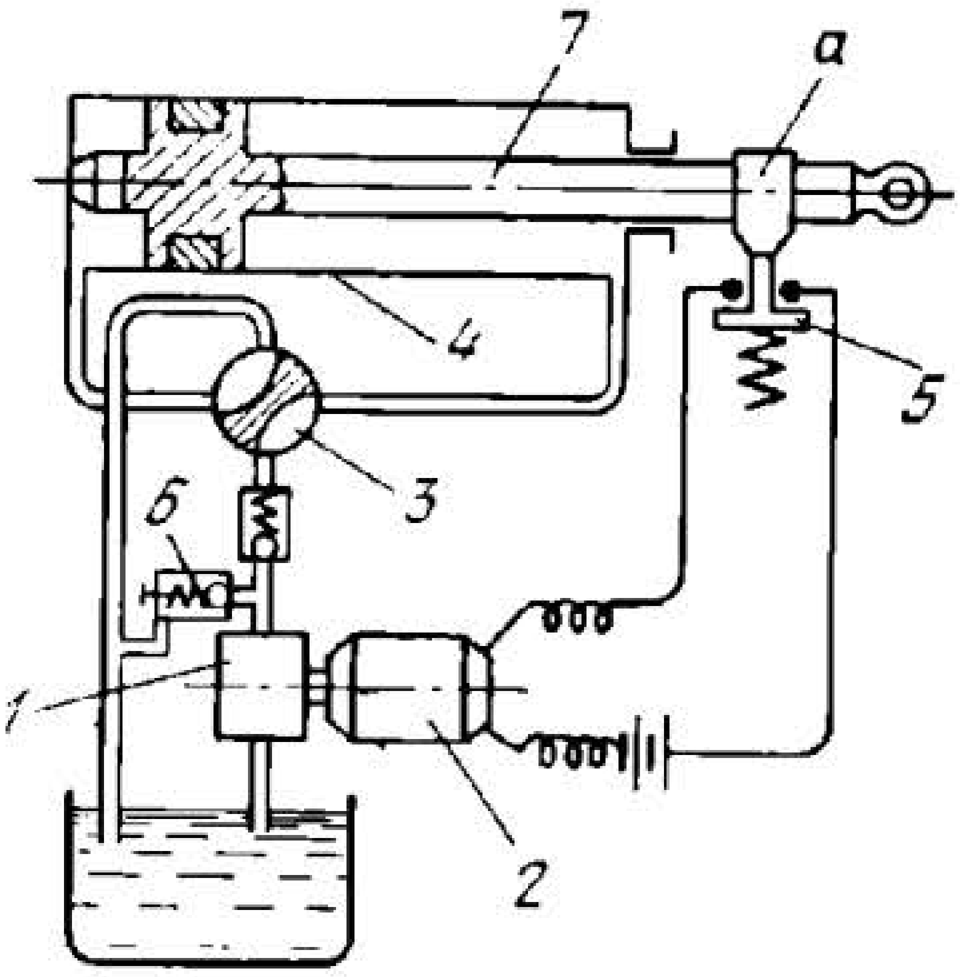
Fluid at constant pressure is delivered along pipeline *a* to valve spool *4*. In the left-hand position of spool *4*, fluid is discharged to the tank, and in the right-hand position, along pipeline *b* to valve spool *3*. If valve spool *3* is in its left-hand position, fluid is delivered along pipeline *d* to the right end of cylinder *6*, and piston *1*, together with machine tool table *2*, moves to the left. Fluid from the left (exhaust) end of cylinder *6* is discharged through pipelines *c*, *g* and *e* to valve spool *5*. If valve spool *3* is in its right-hand position, piston *1* and table *2* move to the right and fluid from the right end of the cylinder is discharged along pipelines *d* and *e* to valve spool *5*. If spool *3* is in its central position, the table stops. In the right-hand position of valve spool *5*, the exhaust fluid is discharged along pipeline *f* directly to the tank and the table travels at maximum speed. In the left-hand position of spool *5*, the fluid is discharged along pipeline *l* to pressure reducing valve *7* and flow-control valve *8*. This regulates the pressure in cylinder *6* so that piston *1* and table *2* travel at the required speed. Pressure reducing valve *7* provides for a constant pressure of the fluid before flow-control valve *8*. As valve *8* is gradually closed, the pressure is increased and table *2* travels at lower speed. In this case, a part of the fluid delivered by pump *10* is discharged by relief valve *9* back to the tank through pipeline *m*. Fluid is delivered to valve *9* through pipeline *k*.

4161	HYDRAULIC DRIVE MECHANISM WITH AN UNLOADING VALVE AND AN ACCUMULATOR	CHP Dr



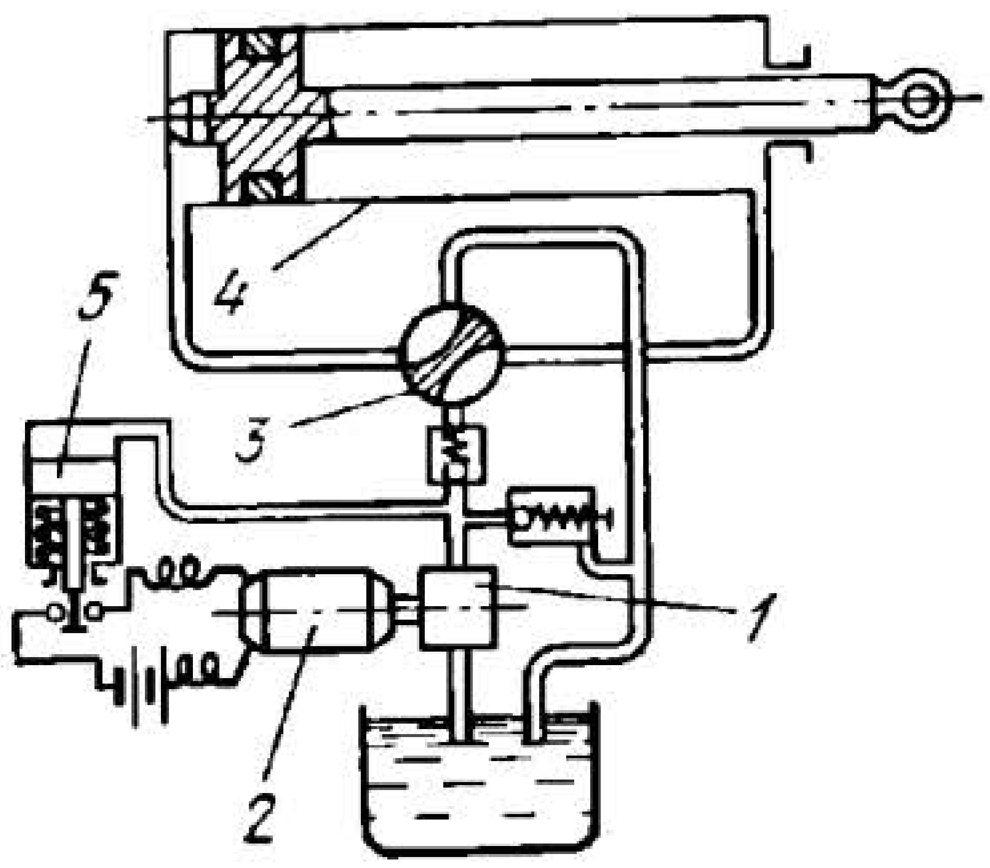
Pump *1* delivers fluid to rotary directional valve *2* from where it is admitted to one or the other end of the cylinder, moving piston *8* in the opposite direction. At the same time, fluid from the pump is delivered to hydropneumatic accumulator *3* and to unloading valve *4*. At the end of the piston stroke, the fluid pressure in the working line and in accumulator *3* increases, spool *5* moves to the left (as shown), shifting ball valve member *6* and connecting pump *1* to tank *7* through pipeline *9*. When valve *2* is switched over, the pressure in accumulator *3* drops, and spool *5* and ball *6* are returned by springs to the initial position. This disconnects pump *1* from tank *7*.

4162	HYDRAULIC DRIVE MECHANISM WITH LIMIT-SWITCH PUMP UNLOADING	CHP Dr



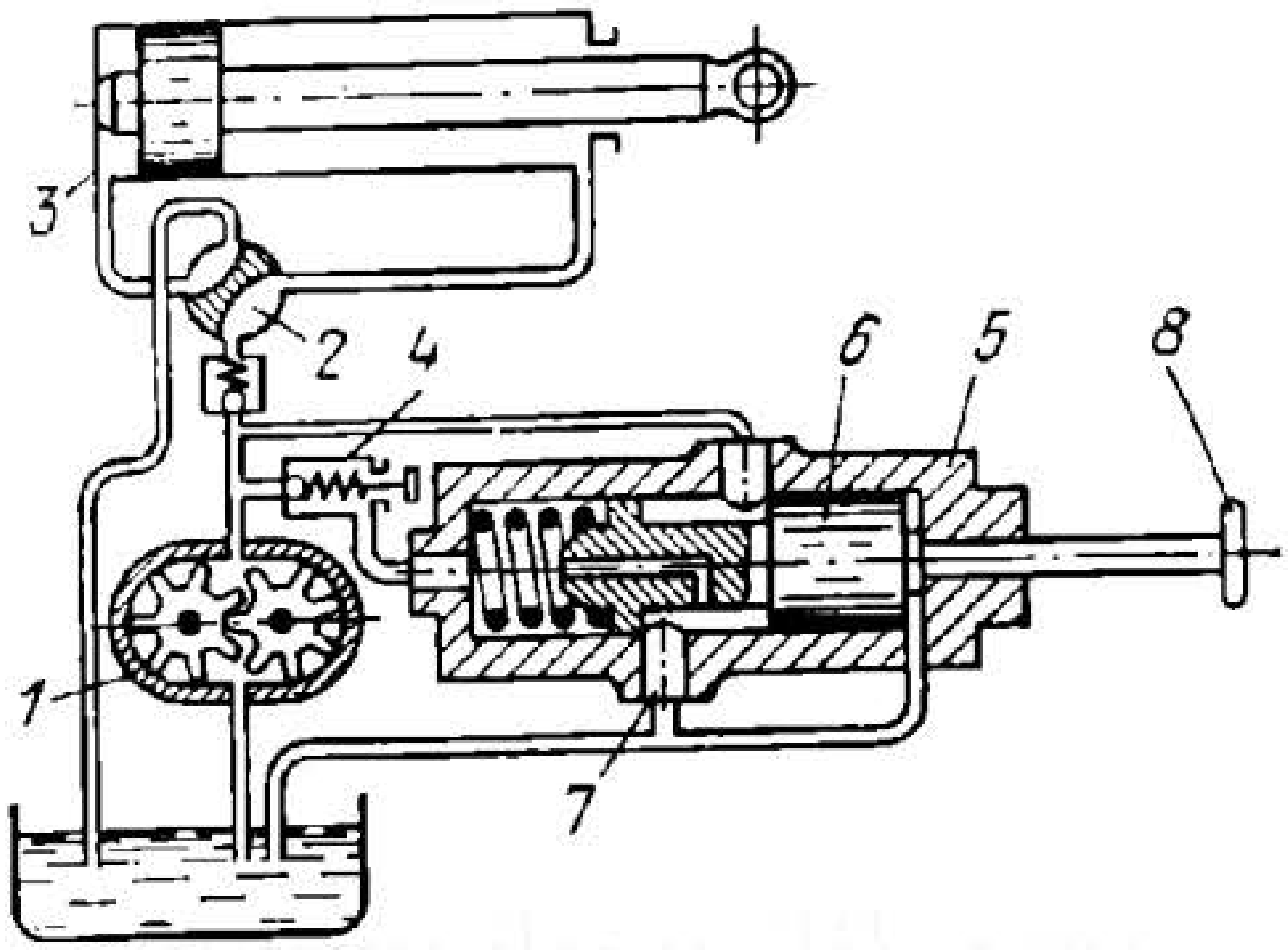
Pump 1, driven by electric motor 2, delivers fluid through rotary directional valve 3 to one or the other end of power cylinder 4. At the end of the stroke, trip dog *a* on piston rod 7 actuates limit switch 5 to switch off electric motor 2. Relief valve 6 protects the system against excess pressure.

4163	HYDRAULIC DRIVE MECHANISM WITH PRESSURE-RELAY PUMP UNLOADING	CHP Dr



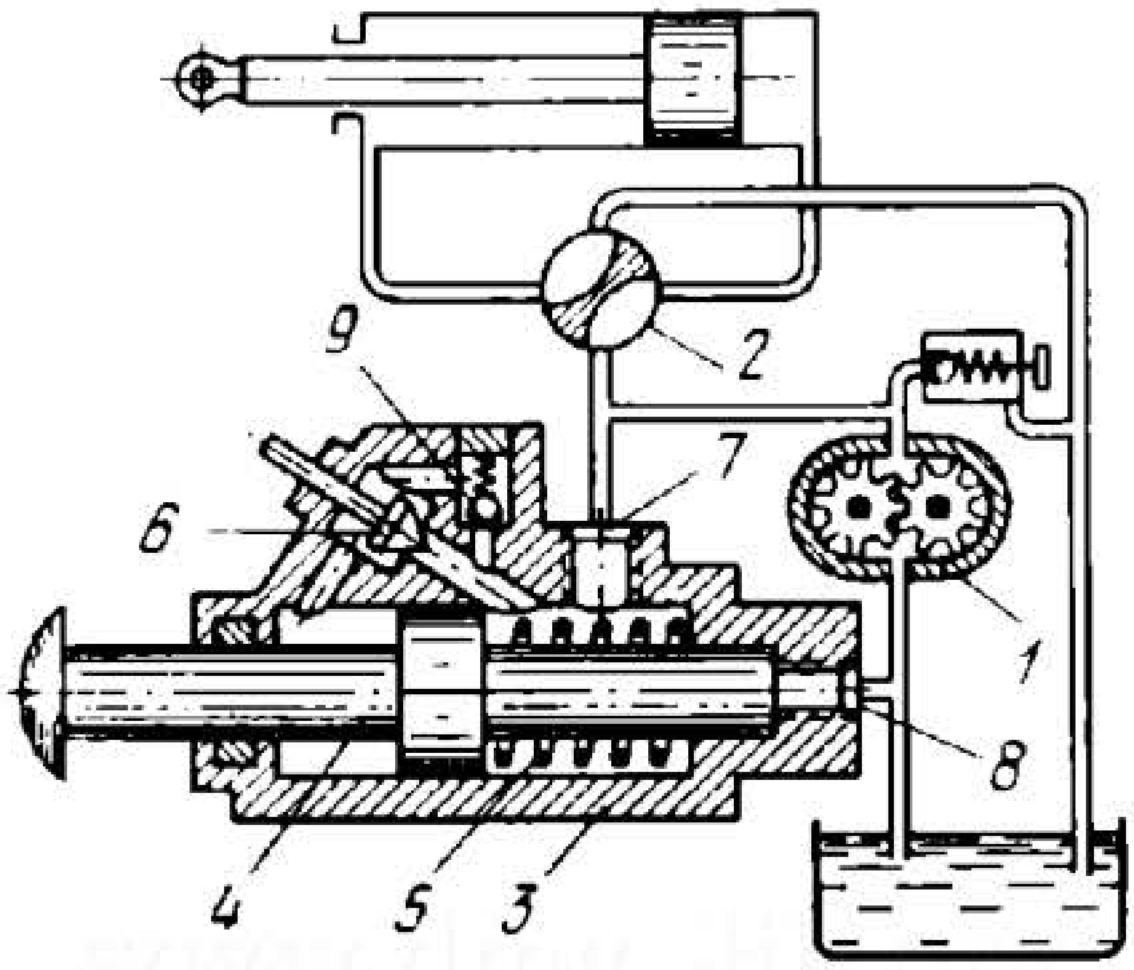
Pump 1, driven by electric motor 2, delivers fluid through rotary directional valve 3 to one or the other end of power cylinder 4, moving the piston and rod in the opposite direction. Upon an increase in pressure, spool 5 of the pressure relay moves downward and its stem actuates a limit switch to switch off the pump drive motor.

4164	HYDRAULIC DRIVE MECHANISM WITH AUTOMATIC PUMP UNLOADING	CHP Dr



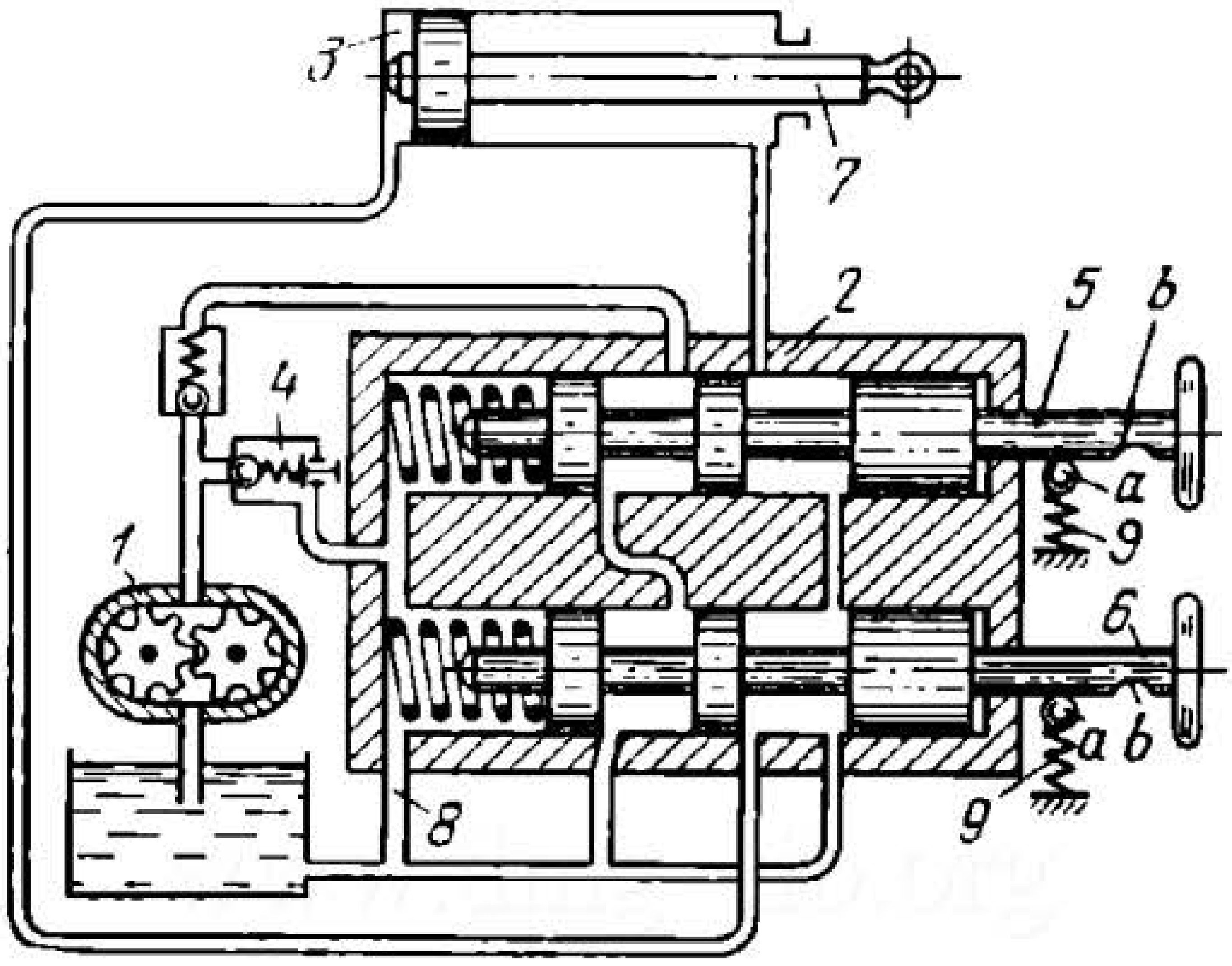
As shown, pump *1* is being unloaded and fluid from the pump passes through automatic valve *5* and port 7 to the tank. During the working operation, spool *6* should be shifted to the left by pushing button *8* and held by a latch (not shown). Fluid is delivered by pump *1* through rotary directional valve *2* to one or the other end of cylinder *3*, depending upon the position of valve *2*. When the pressure in the system increases during the working operation, a part of the fluid is discharged through valve *4* and port 7 to the tank. At the end of the working stroke, the pressure increases to the extent that it overcomes the resistance of the spring of valve *4* and the latch, so that spool *6* is shifted to the right as shown.

4165	HYDRAULIC DRIVE MECHANISM WITH PUMP UNLOADING AND A TIME RELAY	CHP Dr



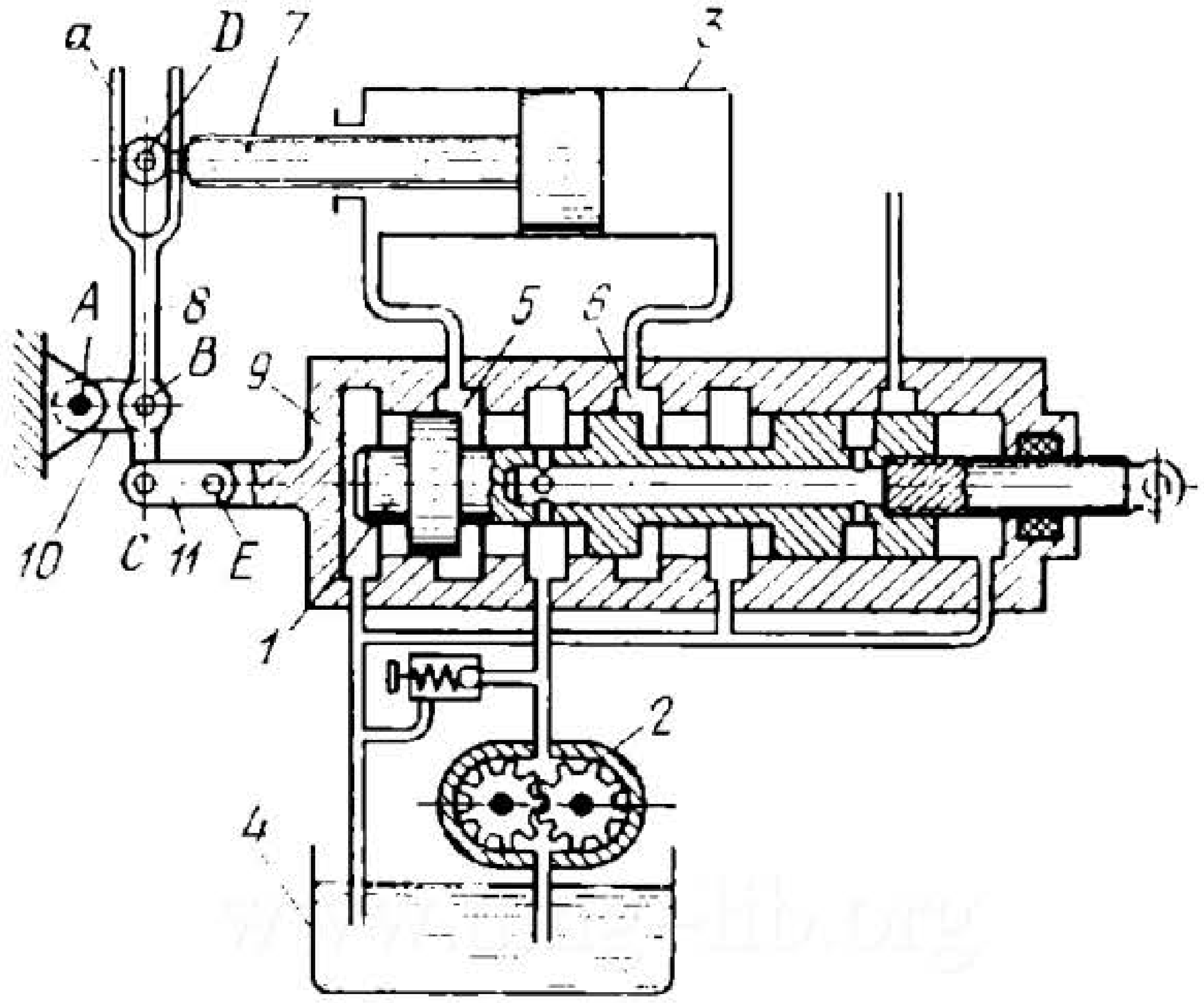
The time relay switches pump 1 to idle running after a preset time interval. Pump 1 delivers fluid to rotary directional valve 2 and, simultaneously, through port 7 and valve 9 to both ends of time relay 3. Plunger 4 of the time relay, moved to the left by spring 5, forces the fluid out of the left end of the relay into the right end. Throttle valve 6 enables the speed of return motion of plunger 4 to be regulated. After the plunger has moved to the left sufficiently to connect ports 7 and 8, pump 1 idles (delivering fluid back to the tank). To switch back to working operation, it is necessary to push the knob of plunger 4 again.

4166	HYDRAULIC DRIVE MECHANISM WITH A LOCKING DEVICE	CHP Dr



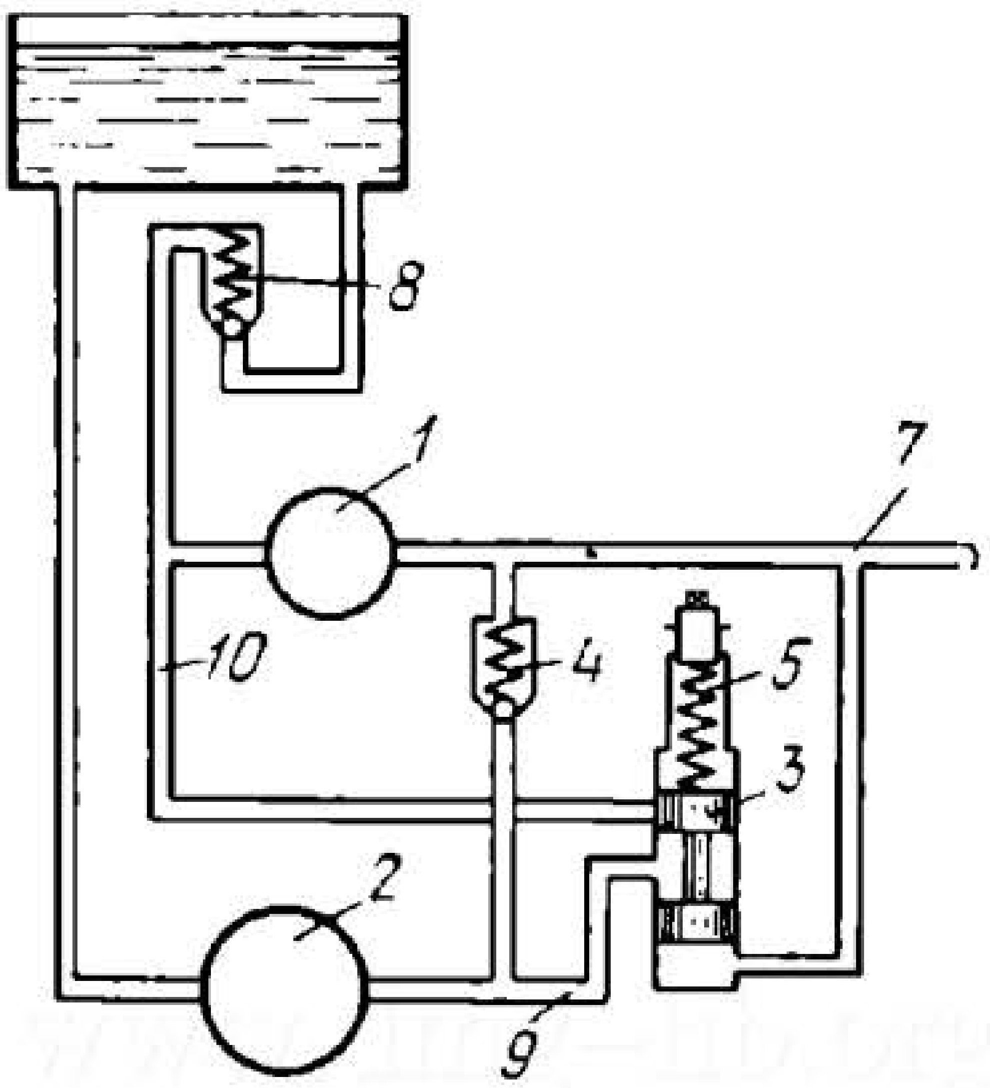
As shown, fluid from pump *1* is being discharged through directional valve *2* to the tank and piston *7* is stationary. When spool *6* is shifted to the left, fluid is delivered by pump *1* to the left end of cylinder *3*, moving piston *7* to the right. At the end of the stroke, the pressure in the system increases and fluid passes through relief valve *4* to the left end of valve *2*, shifting spool *6* to its initial position and connecting the pump to the tank through pipeline *8*. When spool *5* is shifted to the left, piston *7* moves to the left. Spools *5* and *6* are locked by balls *a*, held by springs *9* in recesses *b* in the stems of the spools.

4167	HYDRAULIC DRIVE MECHANISM WITH FEEDBACK	CHP Dr



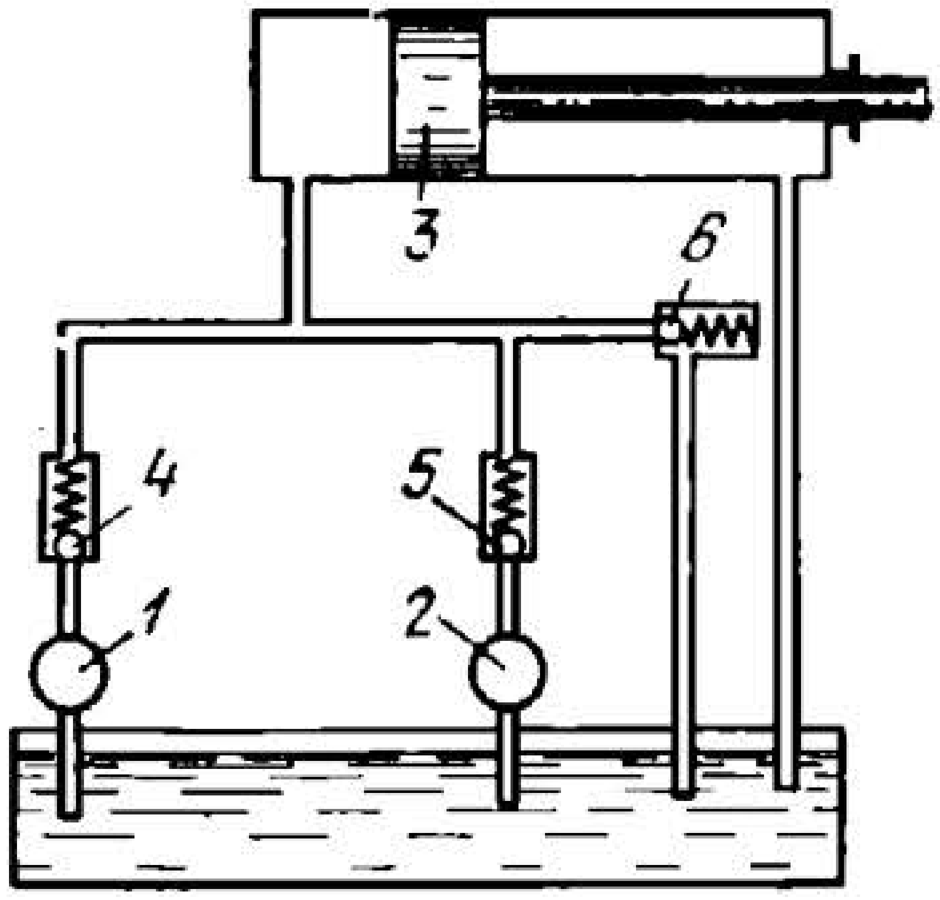
Link *10* turns about fixed axis *A* and is connected by turning pair *B* to lever *8* which, in turn, is connected by turning pair *C* to link *11*. Link *11* is connected by turning pair *E* to valve housing *9*. Lever *8* has fork *a* which engages pin *D* of piston rod *7*. When valve spool *1* is shifted to the left, fluid is delivered by pump *2* through port *5* to the left end of power cylinder *3*, moving its piston to the right. At the same time, fluid from the right end of cylinder *3* is discharged through port *6* to tank *4*. By lever *8*, piston rod *7* is linked to valve housing *9* which, consequently, moves to the left when piston rod *7* moves to the right. When the motion of spool *1* is stopped, fluid continues to be delivered to the left end of cylinder *3* until housing *9* reaches a position in which port *5* is blocked off by a land of spool *1*. At the same time, port *6* is blocked off by another land. This will stop fluid delivery to cylinder *3* and discharge from the cylinder, locking the piston in a definite position. When valve spool *1* is shifted in the other direction, the process is repeated in the reverse direction.

4168	TWO-PUMP HYDRAULIC DRIVE MECHANISM WITH AN AUTOMATIC VALVE	CHP Dr



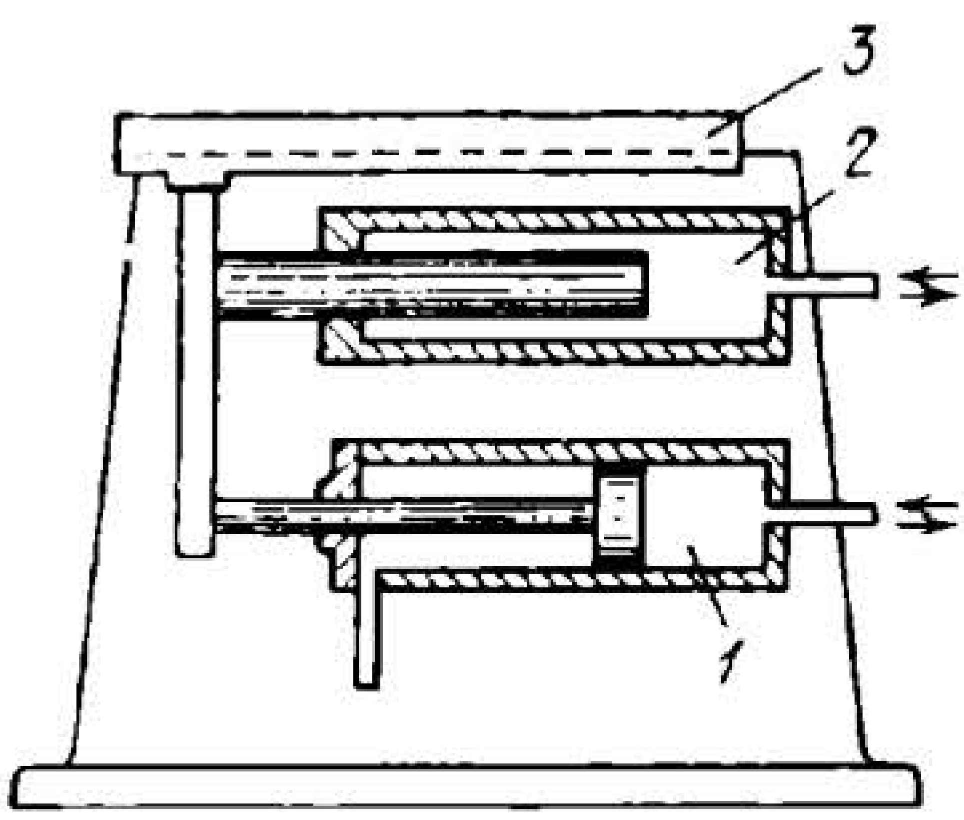
Automatic valve with spool *3* controls the operation of two hydraulic pumps, *1* and *2*, so that they operate in parallel up to a definite pressure, and in series at higher pressures. Up to a definite pressure, set by adjusting spring *5*, both pumps deliver fluid to pipeline *7* and their outputs are added together. At this, valve spool *3* is in the position shown. When the pressure increases above the preset value, spool *3* is raised so that fluid is delivered under pressure from pump *2* through the valve and pump *1* along pipes *9* and *10*. At this, check valve *8* closes off fluid supply from the tank to pump *1*. Pump *1*, drawing in fluid under pressure, raises its pressure so that the pressures are added together when the pumps operate in series. In this case, valve *4* closes because the pressure in pipeline *7* is higher than in pipe *9*.

4169	THREE-STAGE HYDRAULIC DRIVE MECHANISM	CHP Dr



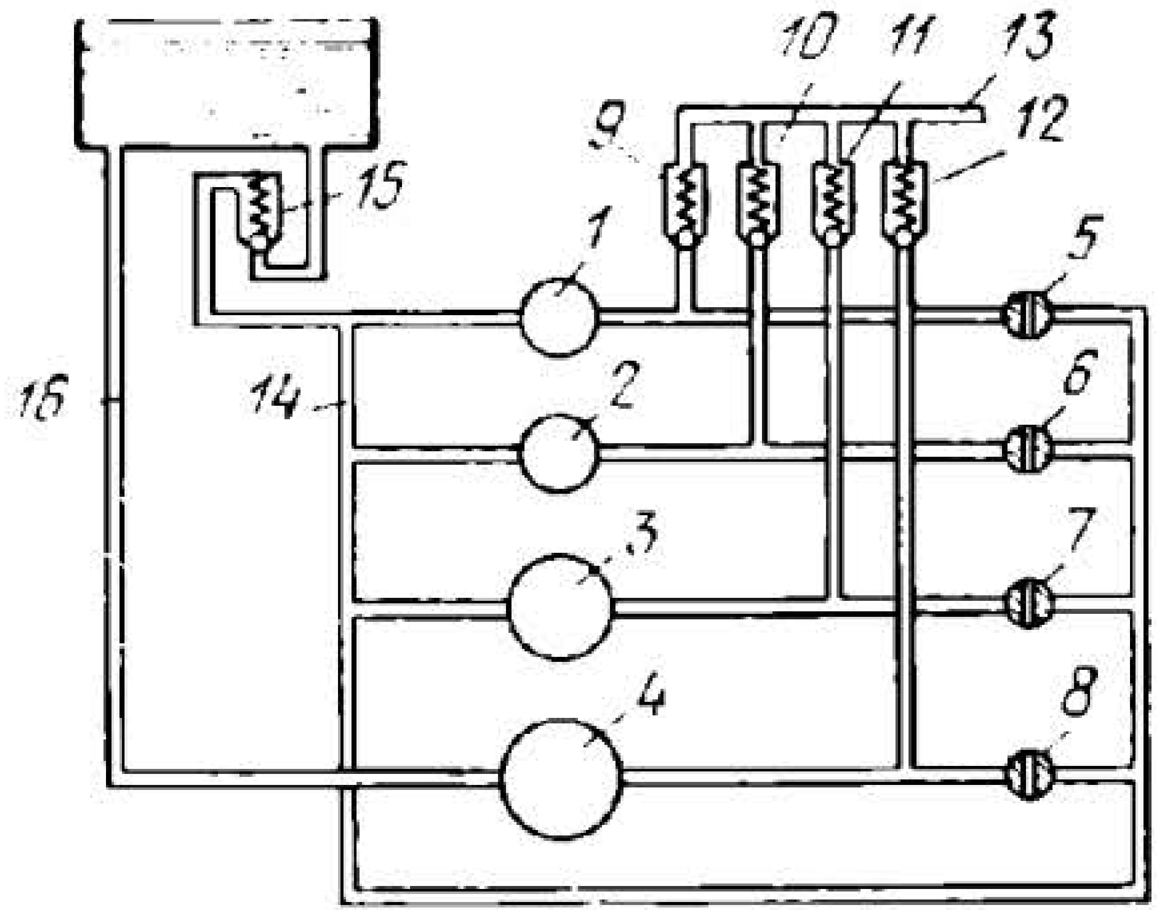
The system provides for three speeds of travel of piston *3*: with only pump *1* switched on, with only pump *2* switched on and with both pumps switched on. Check valves *4* and *5* enable the pumps to operate separately. The system is protected against overloads by relief valve *6*.

4170	MULTIPLE-STAGE HYDRAULIC DRIVE MECHANISM	CHP Dr



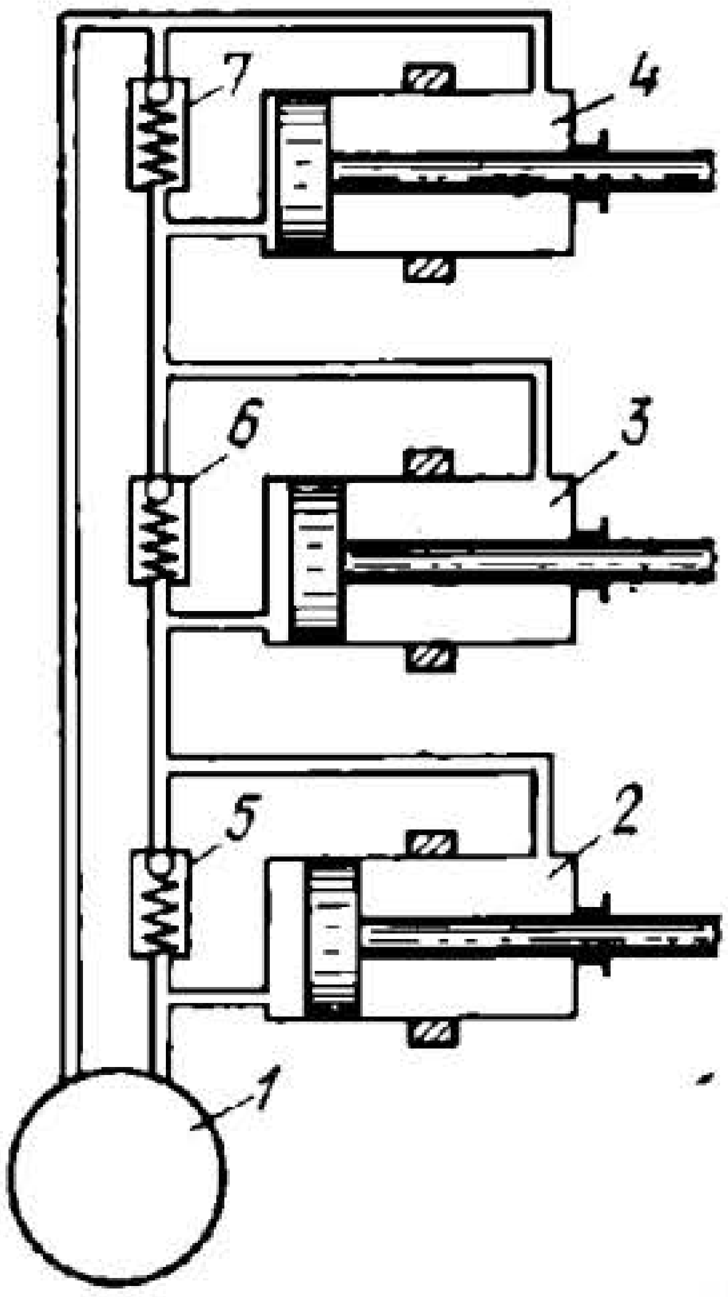
When fluid is delivered to the right end of cylinder *1*, table *3* travels at medium speed. When fluid is delivered only to cylinder *2*, table *3* travels at its highest speed, and when fluid is delivered to cylinder *2* and to the right end of cylinder *1*, table *3* travels at its lowest speed. For the rapid return stroke, fluid is delivered only to the left end of cylinder *1* and is discharged from the right end and from cylinder *2* to the tank.

4171	MULTIPLE-STAGE HYDRAULIC DRIVE MECHANISM	CHP Dr



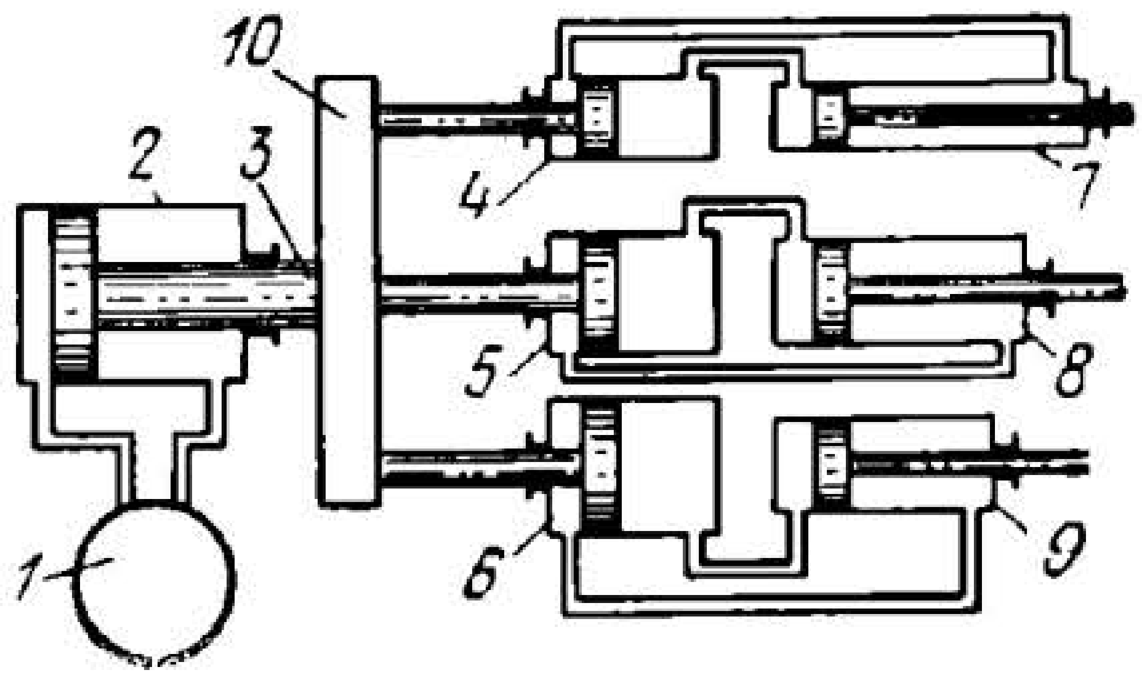
Pumps *1*, *2* and *3* are connected to the tank through pipe *14* with check valve *15* which prevents fluid return to the tank. Pump *4* is connected to the tank through pipe *16*. This arrangement provides for operation in series so that pump *4* delivers fluid through open valve *8* into pipe *14*, valve *15* closes and pumps *1*, *2* and *3*, supplied by fluid under pressure, deliver it into pipeline *13* at double pressure. All four pumps are connected to delivery pipeline *13* through check valves *9*, *10*, *11* and *12*, which prevent fluid in the delivery pipeline from returning to the pumps. Fluid delivery is varied by turning on valves *5*, *6*, *7* and *8* in various combinations. The system can provide 15 different steps of travel of the operating mechanisms connected to pipeline *13*.

4172	HYDRAULIC GROUP DRIVE MECHANISM	CHP Dr



Fluid is delivered by pump *1* into the left end of cylinder *2*. From the right end of this cylinder, fluid is delivered into the left end of cylinder *3*, etc. From the right end of the third cylinder (*4*), fluid is drawn in by pump *1*. For the return strokes, fluid is delivered to the right end of cylinder *4* and the process of flow from cylinder to cylinder is repeated in the reverse order. Check valves *5*, *6* and *7* operate only during the return strokes.

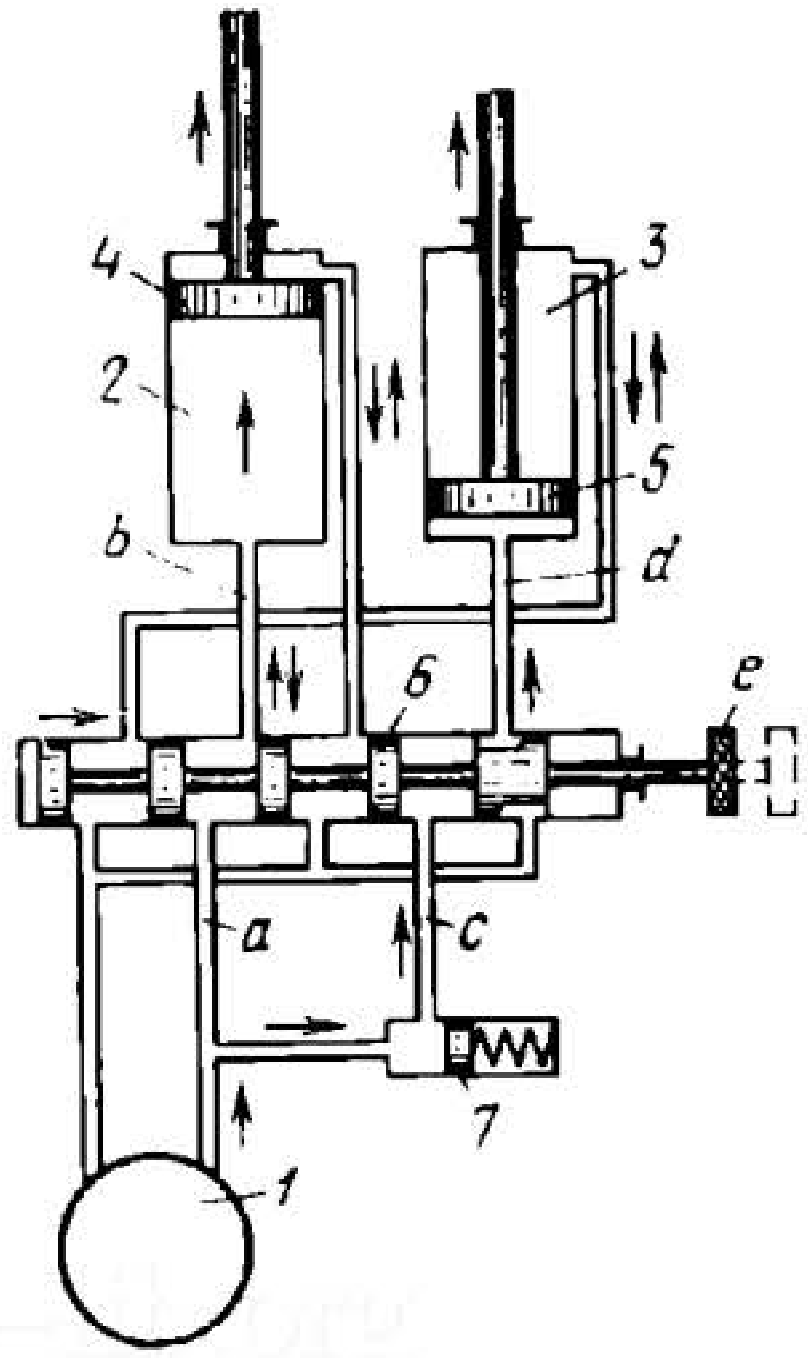
4173	HYDRAULIC GROUP DRIVE MECHANISM	CHP Dr



Pump *1* delivers fluid to the left end of main cylinder *2* during the working stroke, and to the right end, whose effective area is reduced by rod *3*, during the idle return stroke. Piston rod *3* carries crosspiece *10* to which three piston rods of auxiliary cylinders *4*, *5* and *6* are attached. These cylinders are connected by pipelines to power cylinders *7*, *8* and *9*, whose piston rods feed the spindles of the machine tool.

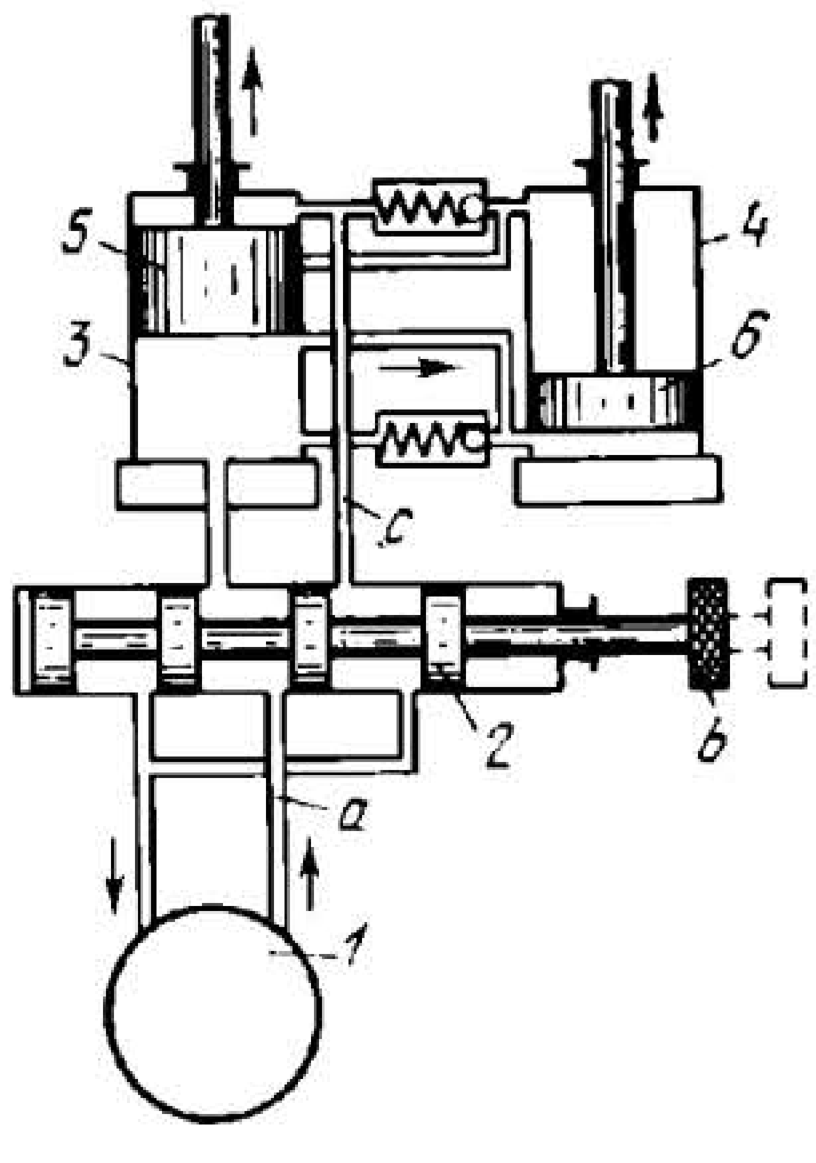
4174	HYDRAULIC GROUP DRIVE MECHANISM	CHP Dr

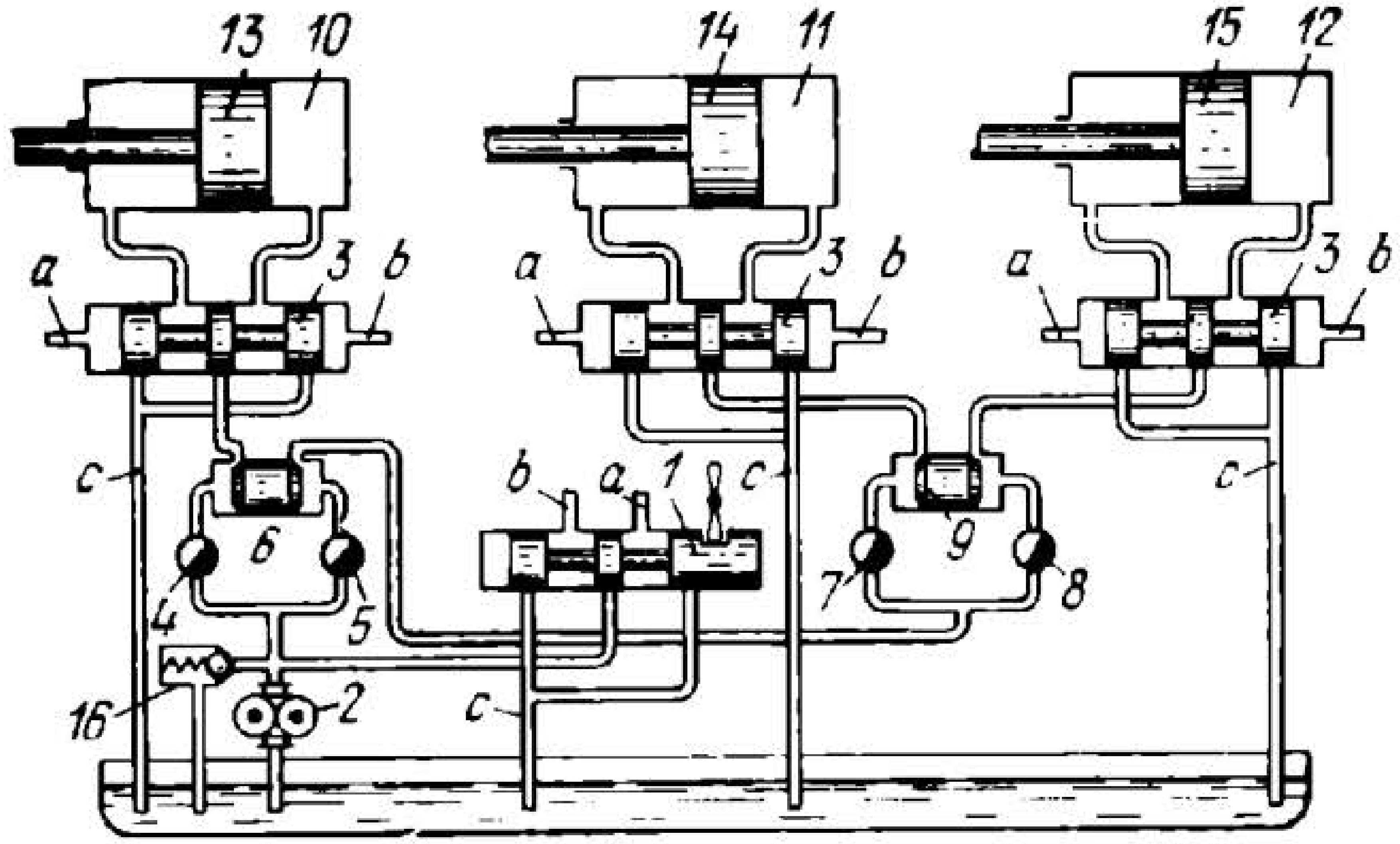
Pump *1* delivers fluid through pipeline *a*, a valve with spool *6* and pipeline *b* to the bottom end of cylinder *2*. When piston *4* reaches its upper position and pressure in the system increases, opening valve *7*, fluid is delivered through pipeline *c*, a groove of spool *6* and pipeline *d* to the bottom end of cylinder *3*. This moves piston *5* upward. For the return strokes, knob *e* of spool *6* is pulled out to the position shown by dash lines, after which pistons *4* and *5* move downward.



4175	HYDRAULIC GROUP DRIVE MECHANISM	CHP Dr

Pump *1* delivers fluid through pipeline *a* and a valve with spool *2* to the bottom end of cylinder *3*. Piston *5* moves upward and after it reaches its upper position, as shown, piston *6* begins to move upward in cylinder *4*. For the return strokes, knob *b* of spool *2* is pulled out to the position shown by dash lines. At this, fluid is delivered by the pump through pipeline *c* to the top end of cylinder *3*. First piston *5* moves downward and then piston *6*.

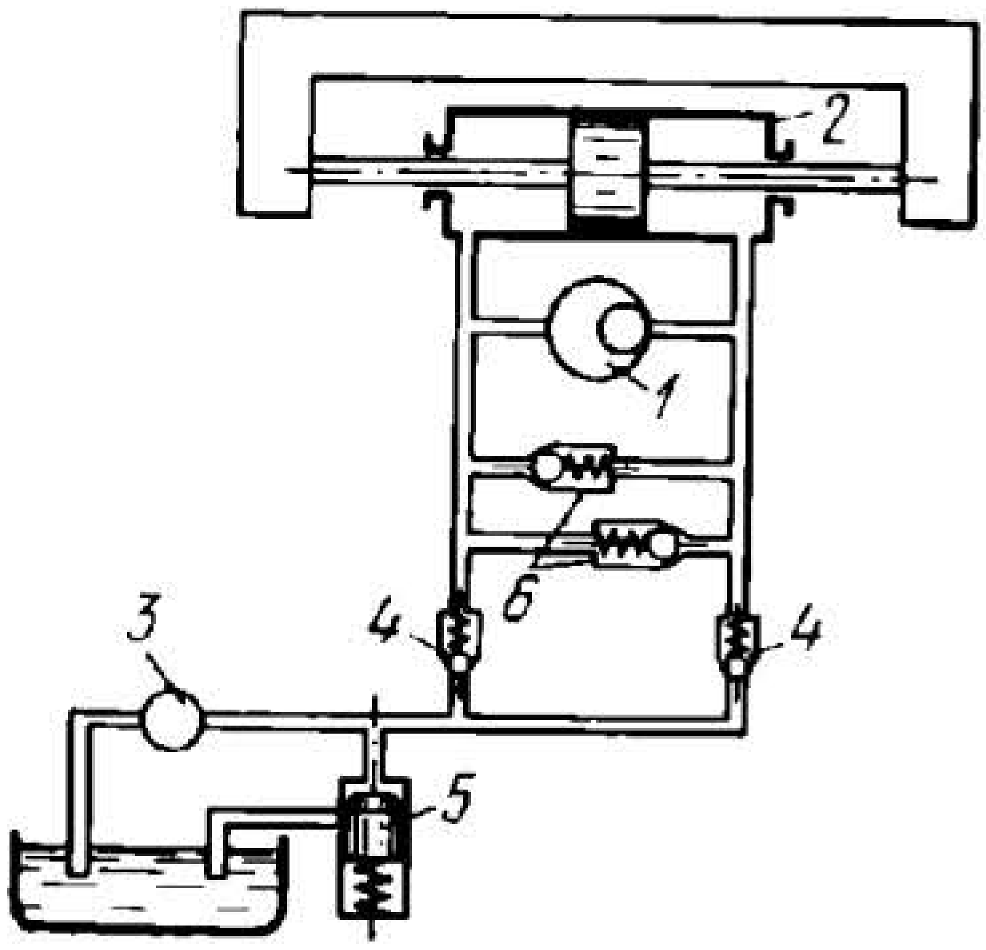




When valve spool *1* is shifted to the left, a part of the fluid delivered by pump *2* at constant pressure passes through pipelines *a* and shifts pilot-operated valve spools *3* to the right. At this, the rest of the fluid passes through flow-control valves *4* and *5*, valve *6*, flow-control valves *7* and *8*, and valve *9*, to the left ends of cylinders *10*, *11* and *12*. Pistons *13*, *14* and *15* move to the right. Fluid from the right ends of the cylinders is discharged along pipelines *c* to the tank. In the right-hand position of valve spool *1*, a part of the fluid is delivered at constant pressure through pipelines *b* and shifts valve spools *3* to the left, and the part of the fluid passing through the flow-control valves is delivered to the right ends of cylinders *10*, *11* and *12*. Pistons *13*, *14* and *15* move to the left and the fluid from the left ends of the cylinders is discharged through pipelines *c* to the tank. In the central positicn of spool *1*, no fluid is delivered through pipelines *a* or *b*, and pistons *13*, *14* and *15* are stationary. In this case, fluid delivered by the pump is by-passed through relief valve *16* to the tank.

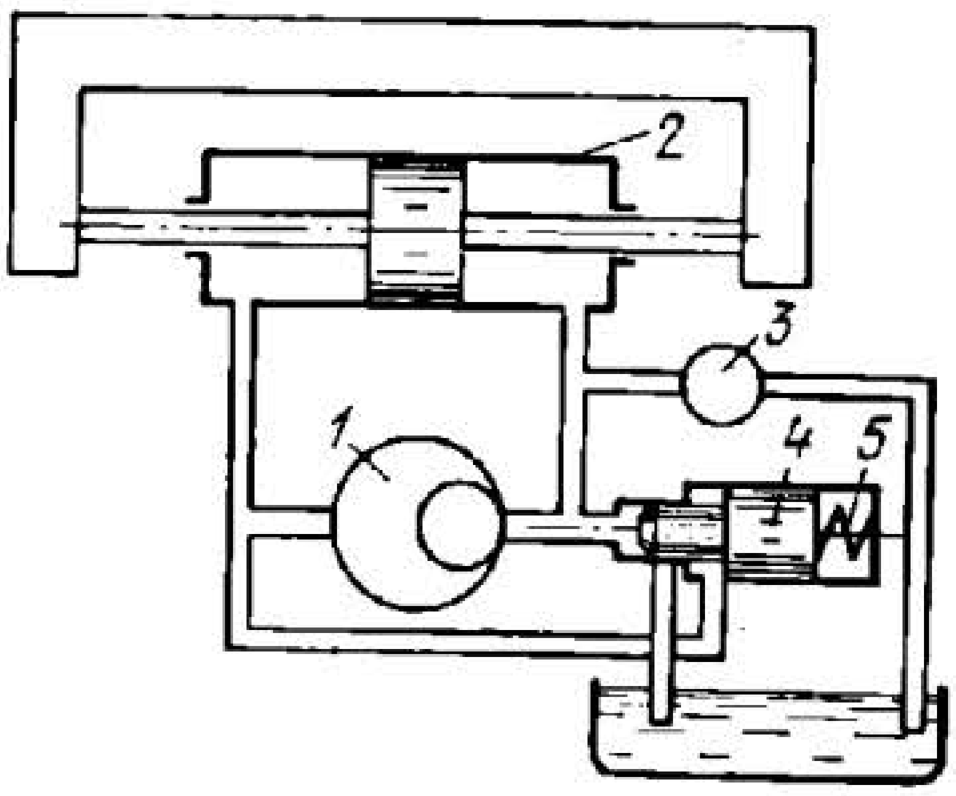
4177	CLOSED-CIRCUIT HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH A COMPENSATING PUMP	CHP Dr

Variable-displacement reversible pump *1* delivers fluid from one end of power cylinder *2* to the other and back again. Pump *3* serves to compensate for leakage in the circuit. When the pressure drops due to leakage, valve *4* opens, admitting fluid from compensating pump *3* into the suction line of pump *1*. Relief valve *5* maintains constant pressure in the delivery line of compensating pump *3*. Valves *6* prevent excess pressure in the delivery line of pump *1*.

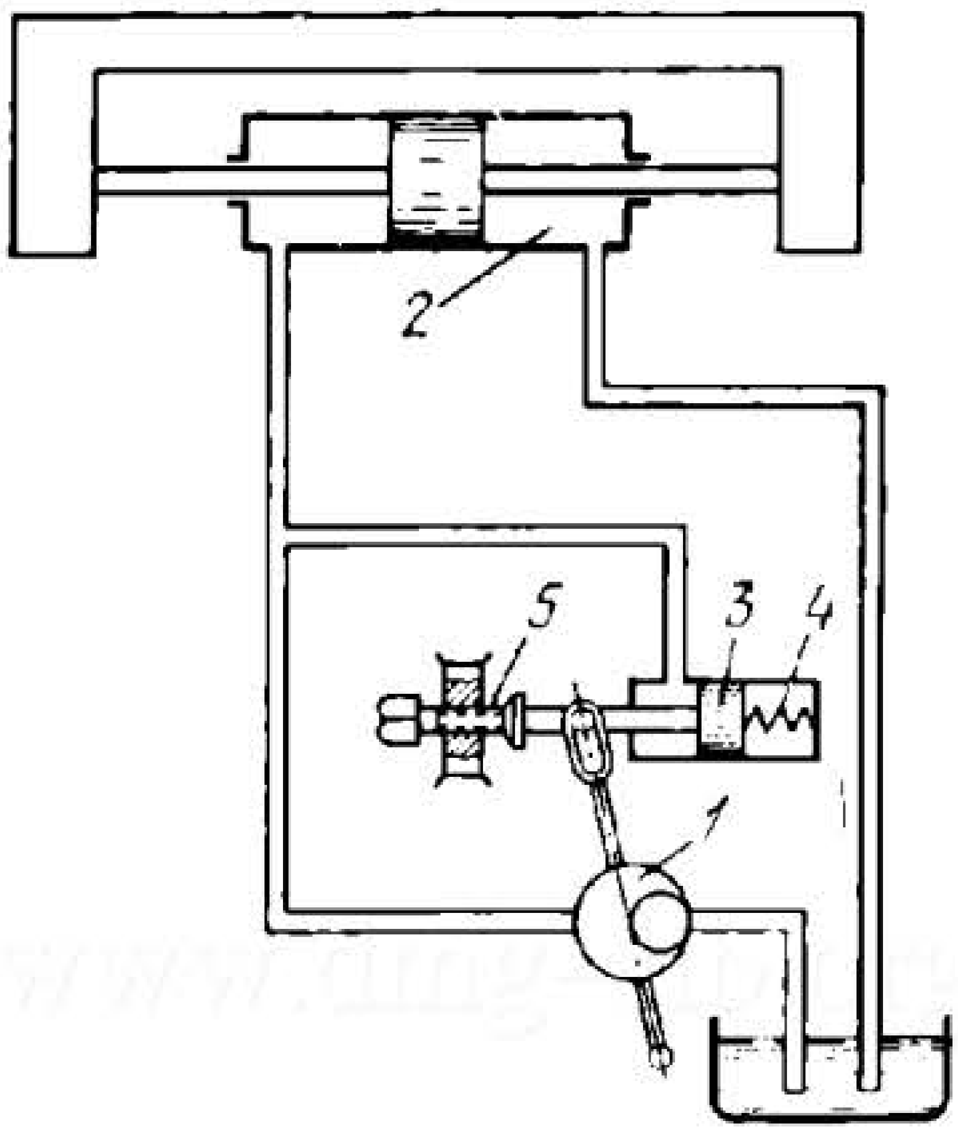


4178	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH LEAKAGE COMPENSATION	CHP Dr

Variable-displacement pump *1* draws in fluid from the left end of power cylinder *2* and delivers it to the right end, to which fluid is also delivered by high-pressure compensating pump *3*, thereby compensating for leakage in the system. Differential valve spool *4* is subject to the pressure of the delivery line and the suction line on one side, and to the action of spring *5* on the other side. Upon an increase in pressure in the system, spool *4* is shifted to the right, by-passing surplus fluid to the tank.

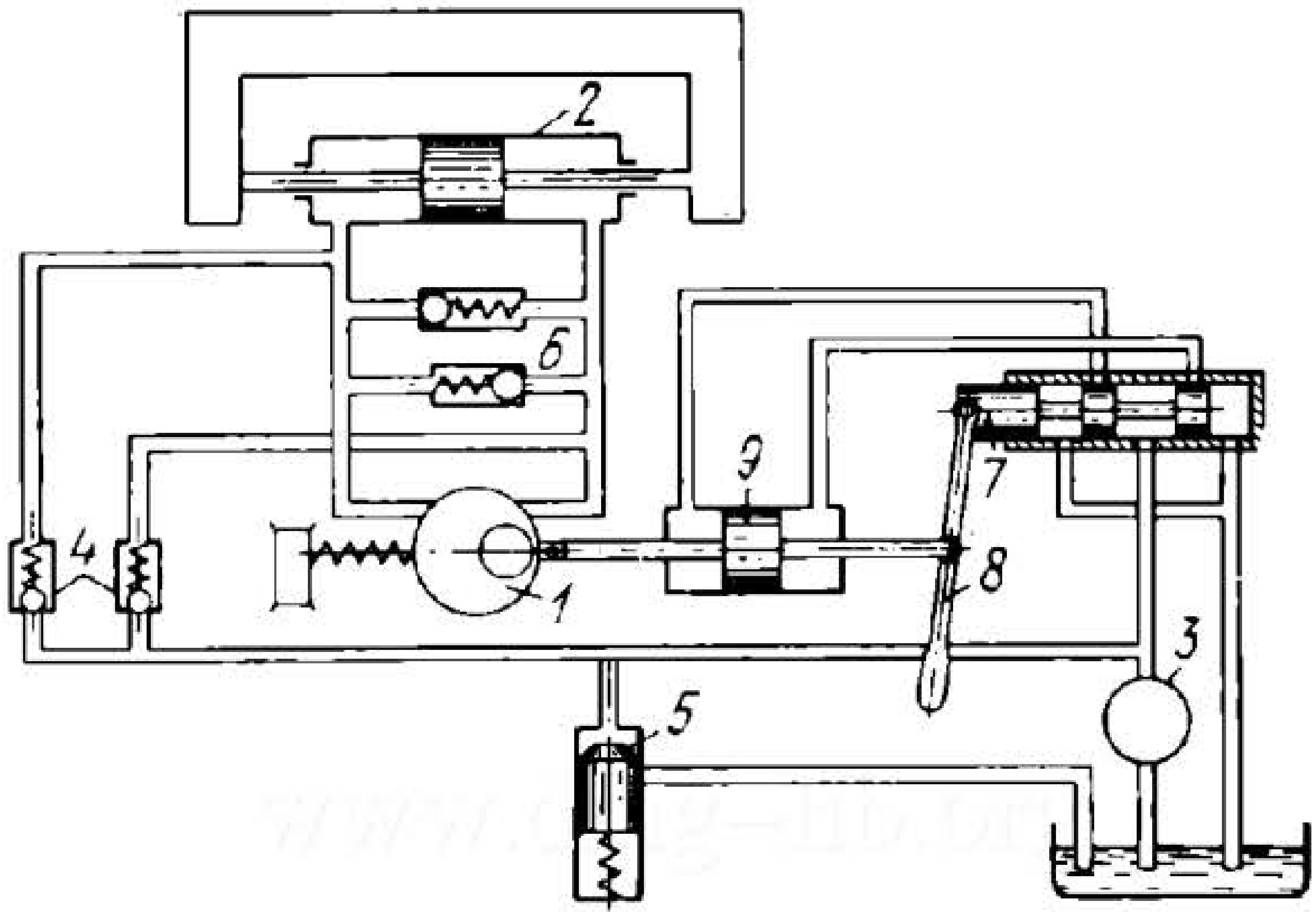


4179	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AUTOMATIC PUMP OUTPUT VARIATION	CHP Dr



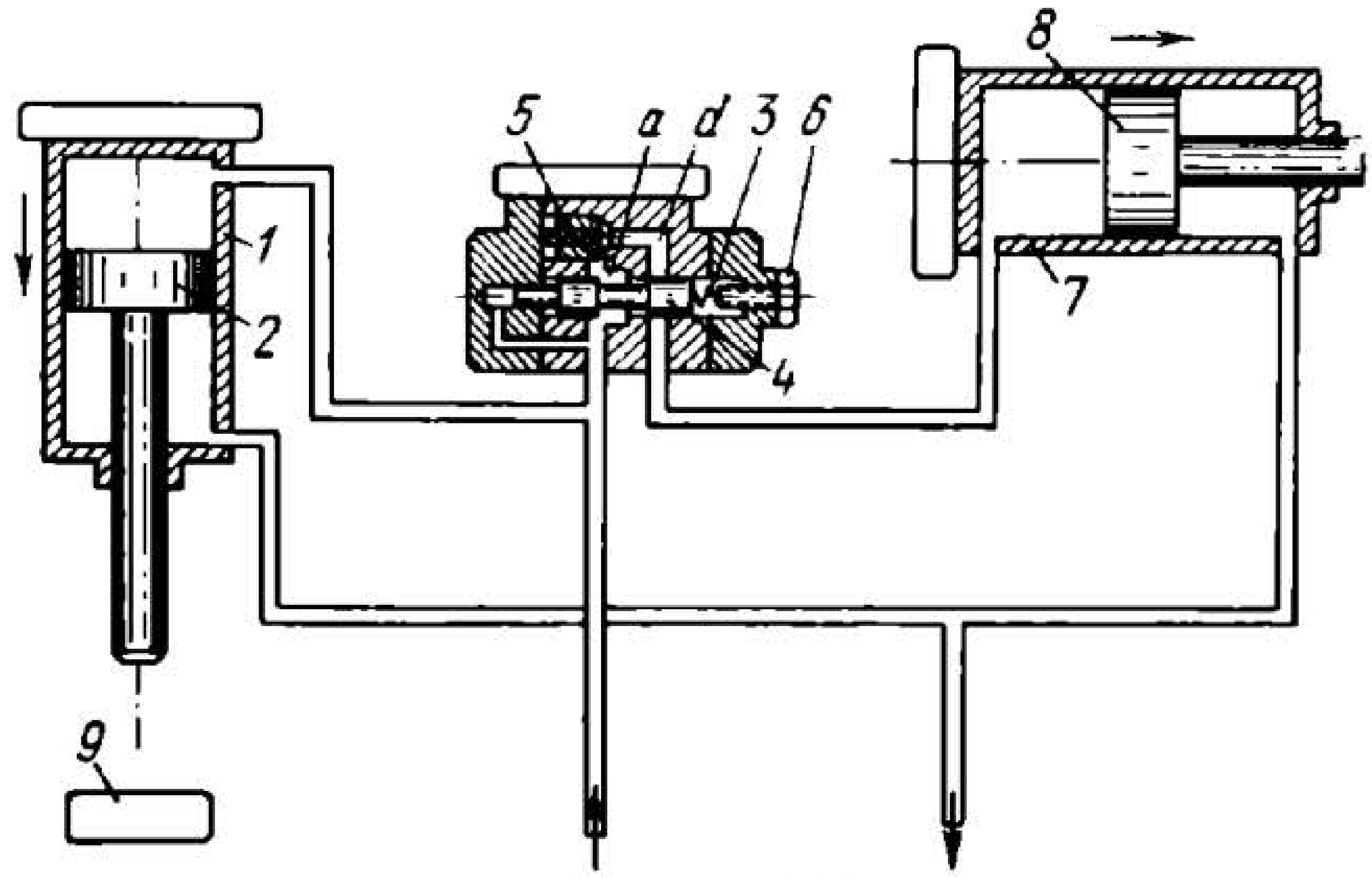
Variable-displacement pump *1* delivers fluid to the left end of power cylinder *2*. From the right end of the cylinder, fluid is discharged to the tank. The delivery line of pump *1* is connected to valve spool *3*, which is subject to the action of spring *4*. Upon a change in pressure in the system, spool *3* is shifted, actuating the mechanism for changing the output of pump *1*. The required pressure in the system is set up by using screw *5* to regulate the force exerted by spring *4*.

4180	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH LEAKAGE COMPENSATION AND PUMP OUTPUT VARIATION	CHP Dr



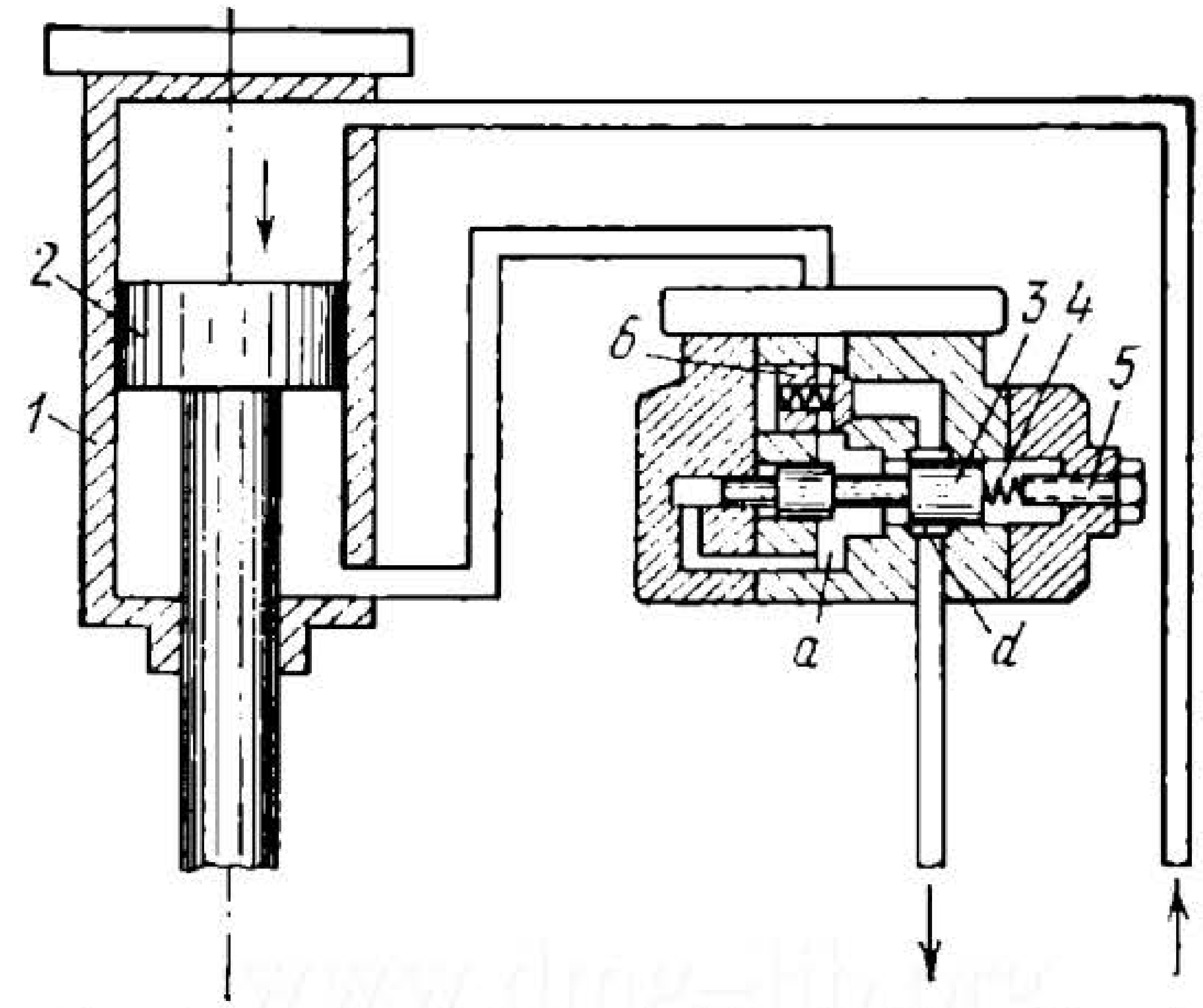
Variable-displacement pump *1* delivers fluid from one end of power cylinder *2* to the other and back again. Compensating pump *3* provides make-up fluid through check valves *4* to compensate for leakage. Relief valve *5* sets up a constant pressure in the delivery line of pump *3*. Relief valves *6* prevent excess pressure in the delivery line of pump *1*. When lever *8* is turned, valve spool *7* is shifted and fluid from pump *3* is delivered to servomotor *9*, moving its piston and changing the output of pump *1*. Upon motion of the piston of servomotor *9*, spool *7* returns to its initial position.

4181	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A COMBINATION VALVE	CHP Dr



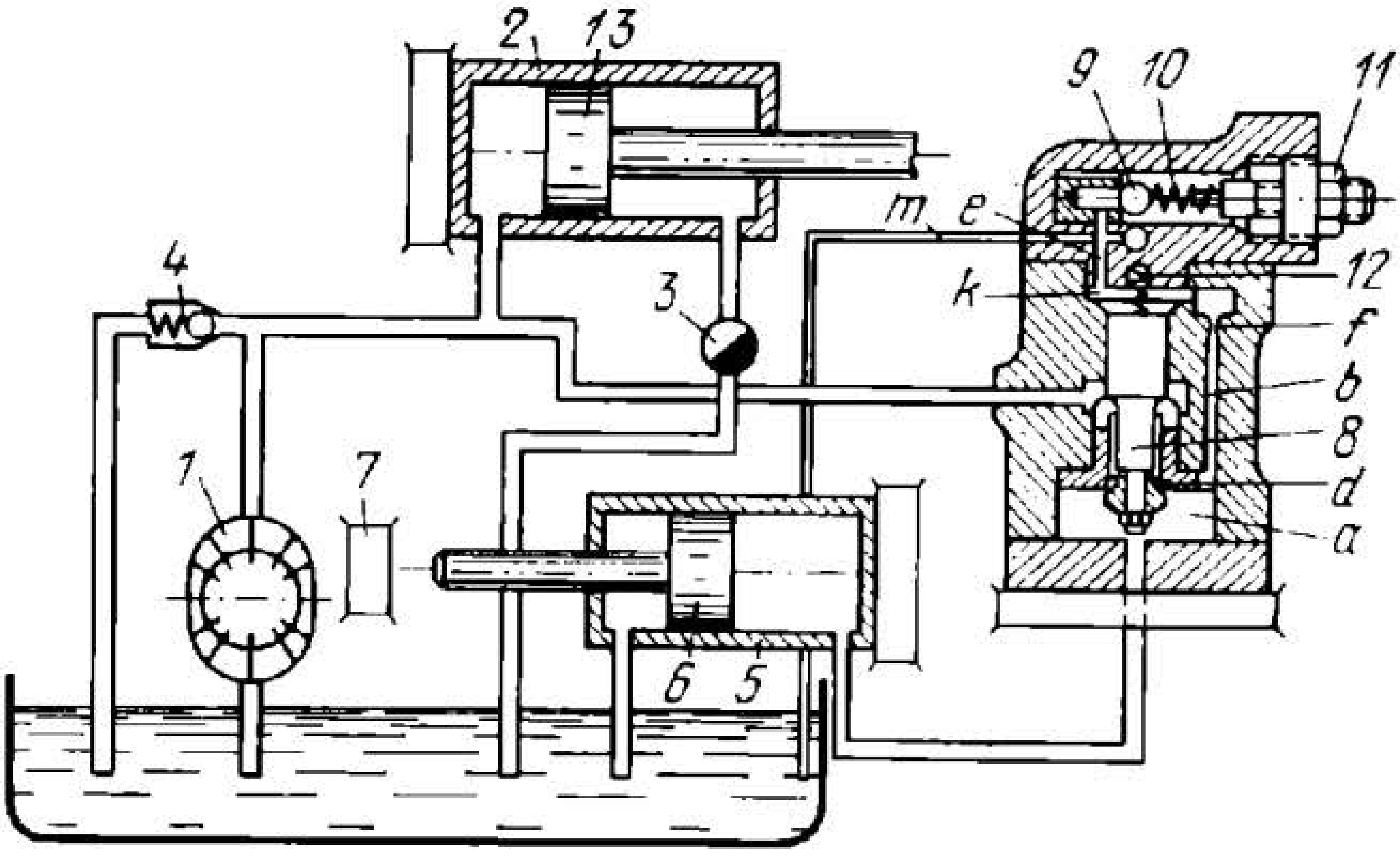
Fluid is delivered from the system to the upper end of cylinder *1* and into chamber *a* of the combination (sequence) valve. Piston *2* is moved downward by the action of the fluid, and the fluid from the lower end of cylinder *1* drains back to the tank. Spring *3* of the combination valve is adjusted by screw *6* so that during the stroke of piston *2*, valve spool *4* is held by spring *3* in its extreme left-hand position, disconnecting chambers *a* and *d*. Check valve *5* is closed. After piston *2* reaches stop *9*, pressure increases in the system and spool *4*, overcoming the resistance of spring *3*, shifts to the right, connecting chambers *a* and *d*. At this, fluid from the system is admitted into the left end of cylinder *7*, moving piston *8* to the right and discharging fluid from the right end of cylinder 7 to the tank. To return the pistons to the initial position, the direction of the fluid in the system is reversed. Fluid is delivered to the lower end of cylinder *1* and to the right end of cylinder *7*, moving pistons *2* and *8* upward and to the left. Fluid from the left end of cylinder *7* flows into chamber *d* of the combination valve and, opening check valve *5*, is discharged to the tank.

4182	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A COMBINATION VALVE	CHP Dr



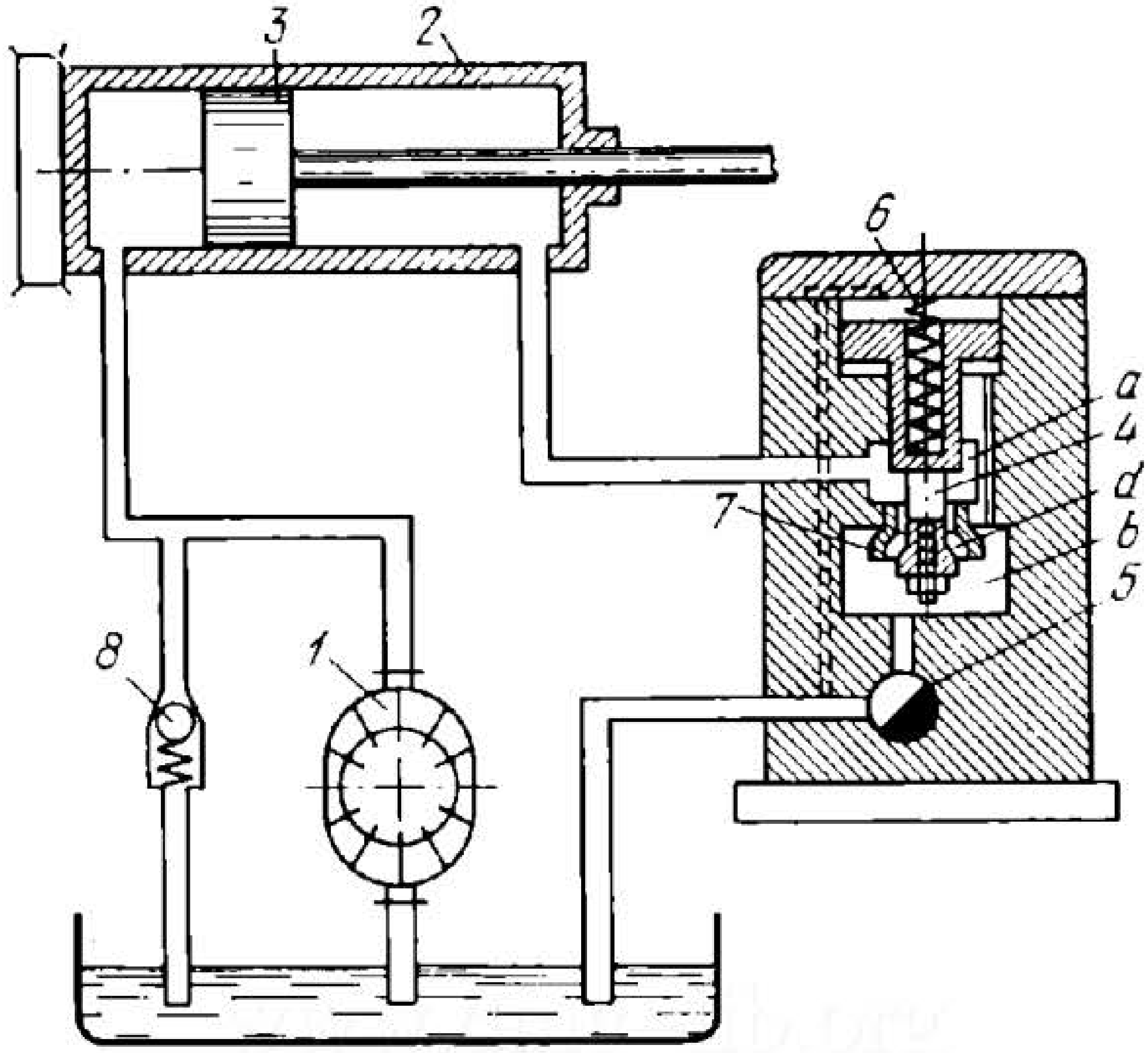
The combination valve is intended for holding the piston of the machine tool in its extreme upper position. Regulating screw *5* of the combination valve is adjusted so that the pressure in the lower end of cylinder *1*, due to the weight of piston *2*, cannot overcome the force exerted by spring *4*. In this case, valve spool *3* is in its left-hand position, disconnecting chambers *a* and *d*. Check valve member *6* is held on its seat by its spring, fluid discharge from the lower end of cylinder *1* is blocked off and piston *2* remains in its upper position until fluid is admitted into the upper end of cylinder *1*. Then piston *2* begins to move downward, the fluid pressure in the lower end of cylinder *1* increases, valve spool *3* is shifted to the right, overcoming the resistance of spring *4* and causing discharge of fluid to the tank. To raise the piston, the flow of fluid is reversed, fluid being directed to the lower end of cylinder *1*, opening check valve *6*. Piston *2* moves upward and fluid from the upper end of the cylinder drains to the tank.

4183	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A PRESSURE REDUCING VALVE	CHP Dr



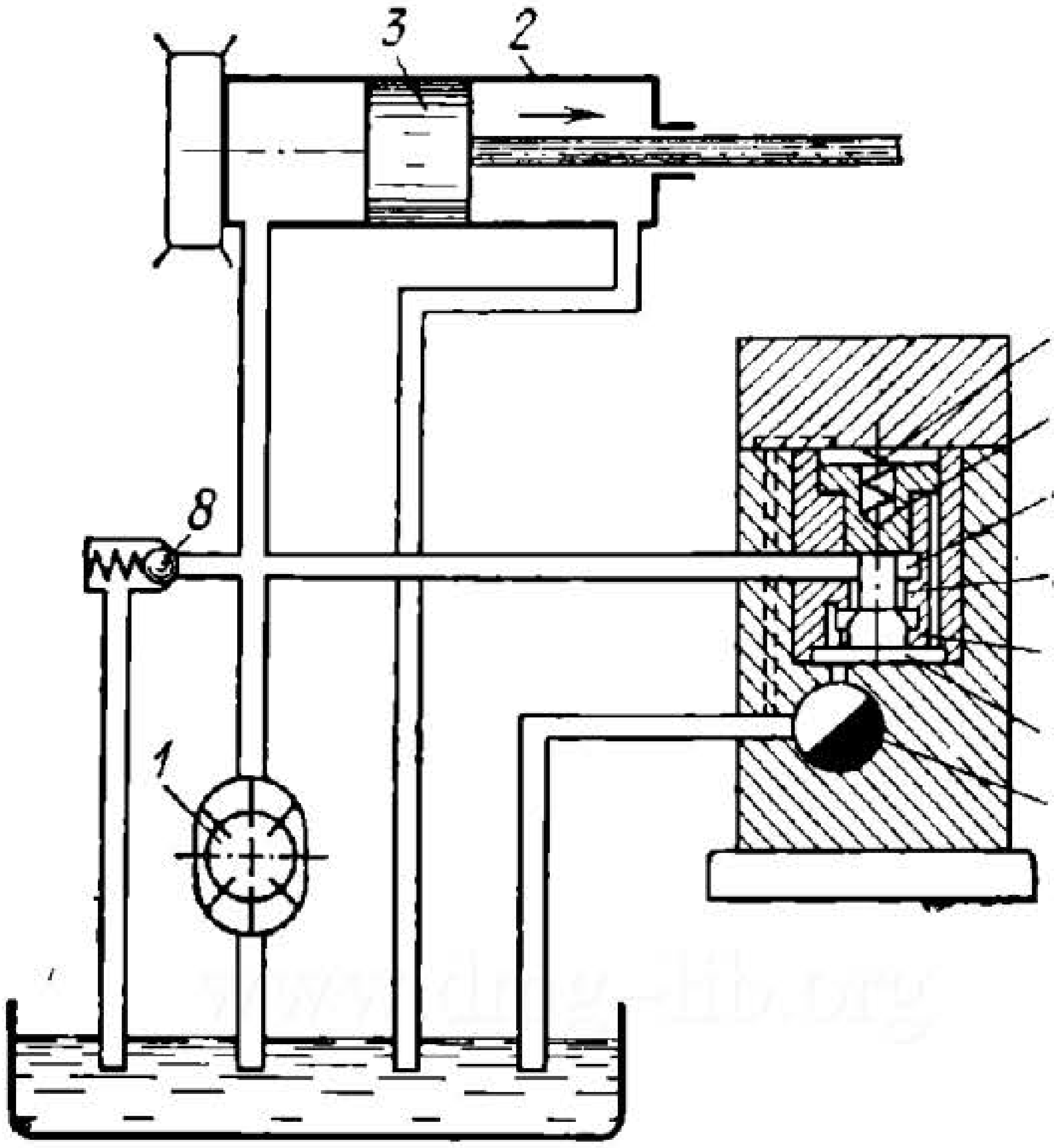
Pump *1* delivers fluid to the left end of cylinder *2* and piston *13* moves to the right. From the right end of cylinder *2* fluid is discharged through flow-control valve *3* to the tank. The pressure developed in the head (left) end of cylinder *2* depends upon the setting of relief valve *4*. The pressure in the head (right) end of cylinder *5*, used for clamping the stock, should be lower than in cylinder *2*. The pressure in the head end of cylinder *5* is regulated as follows. Fluid from the delivery line enters chamber *a* of the pressure reducing valve through slit *d* formed by valve member *8* and its seat. From chamber *a* fluid is delivered to the right end of cylinder *5*. Chamber *a* is connected by passages *b* and *f* to chamber *k* above valve member *8*, from where fluid passes through passage *e* under ball *9*, held on its seat by spring *10*. The pressure is the same in chambers *a* and *k*. Fluid from the system is admitted into cylinder *5*, moving piston *6* over to stop *7*. After piston *6* reaches the stop, fluid pressure in the right end of cylinder *5* and, consequently, in chamber *a* increases until ball *9* is pushed off its seat. At this, fluid is discharged to the tank through pipeline *m*. Since the fluid passes through a passage of small diameter, the pressure becomes higher in chamber *a* than in chamber *k*. As a result, valve member *8* moves upward, reducing the cross section of opening *d* until the pressure in chamber *a* counterbalances the pressure in chamber *k* and the force of spring *12*. Opening (slit) *d* automatically maintains a definite pressure. If the pressure in chamber *a* drops, spring *12* shifts valve member *8* downward, increasing opening *d* and the admission of fluid to chamber *a*. This increases the pressure in this chamber until equilibrium is established. Thus, in chamber *a*, as in the right end of cylinder *5*, the required pressure can be set up by adjusting spring *10* by means of regulating screw *11*.

4184	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A SPEED REGULATOR	CHP Dr



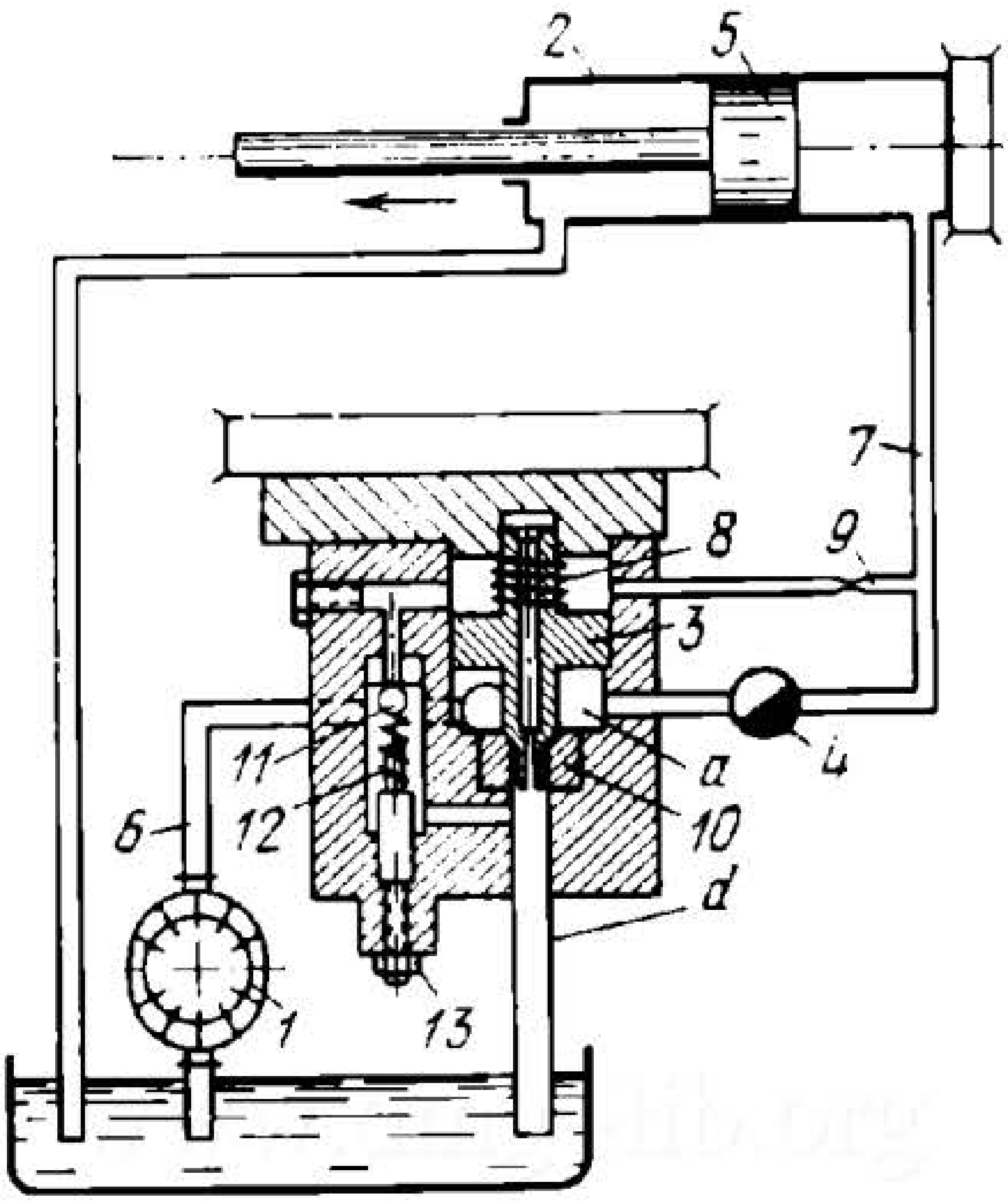
Pump 1 delivers fluid to the left end of power cylinder 2, moving piston 3 to the right. Relief valve 8 maintains constant pressure in the system. Fluid from the right end of cylinder 2 is discharged to chamber *a* of the pressure reducing valve and from the chamber through opening *d*, formed between member 4 and the hole of bushing 7, into chamber *b* with reduced pressure. From here the fluid passes through flow-control valve 5 to the tank. The action of spring 6 on the valve member is counterbalanced by the pressure in chamber *b*. If the pressure increases in the right end of cylinder 2, the reduced pressure also increases and valve member 4 moves upward, reducing opening *d*. This reduces the flow of fluid to chamber *b* and, consequently, the pressure in the chamber. When the pressure drops in the right end of cylinder 2, valve member 4 moves downward, increasing the flow to chamber *b* and the pressure in it. Thus, constant pressure is maintained before flow-control valve 5, providing for constant speed of piston 3 at each setting of valve 5. This arrangement, consisting of a pressure reducing valve and a flow-control valve, serves as a speed regulator.

4185	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A SPEED REGULATOR	CHP Dr



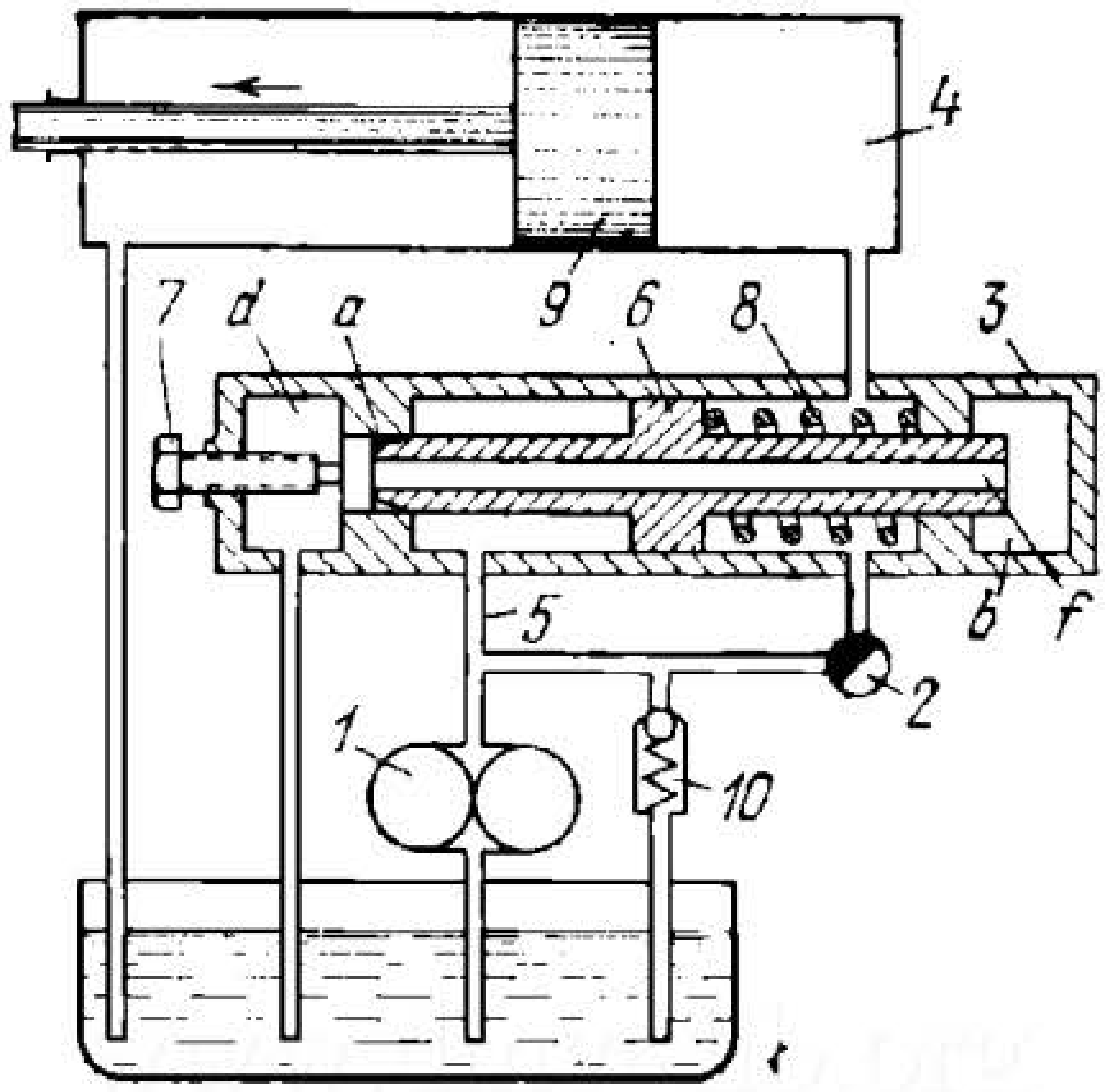
Pump 1 delivers fluid to the left end of power cylinder 2, moving piston 3 to the right. Relief valve 8 maintains constant pressure in the system. A part of the fluid is delivered into chamber *a* of the reducing valve and from there, through opening *d*, formed between valve member 4 and the hole of bushing 7, into chamber *b* with reduced pressure. From there the fluid passes through flow-control valve 5 to the tank. The action of spring 6 on the valve member is counterbalanced by the pressure in chamber *b*. If the pressure increases in the left end of cylinder 2, the reduced pressure also increases and valve member 4 moves upward, reducing opening *d*. This reduces the flow of fluid to chamber *b* and, consequently, the pressure in the chamber. When the pressure drops in the left end of cylinder 2, valve member 4 moves downward, increasing the flow to chamber *b* and, consequently, the reduced pressure. Thus, constant pressure is maintained before flow-control valve 5, providing for constant speed of piston 3 at each setting of valve 5. This arrangement, consisting of a pressure reducing valve and a flow-control valve, serves as a speed regulator.

4186	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A SPEED REGULATOR	CHP Dr



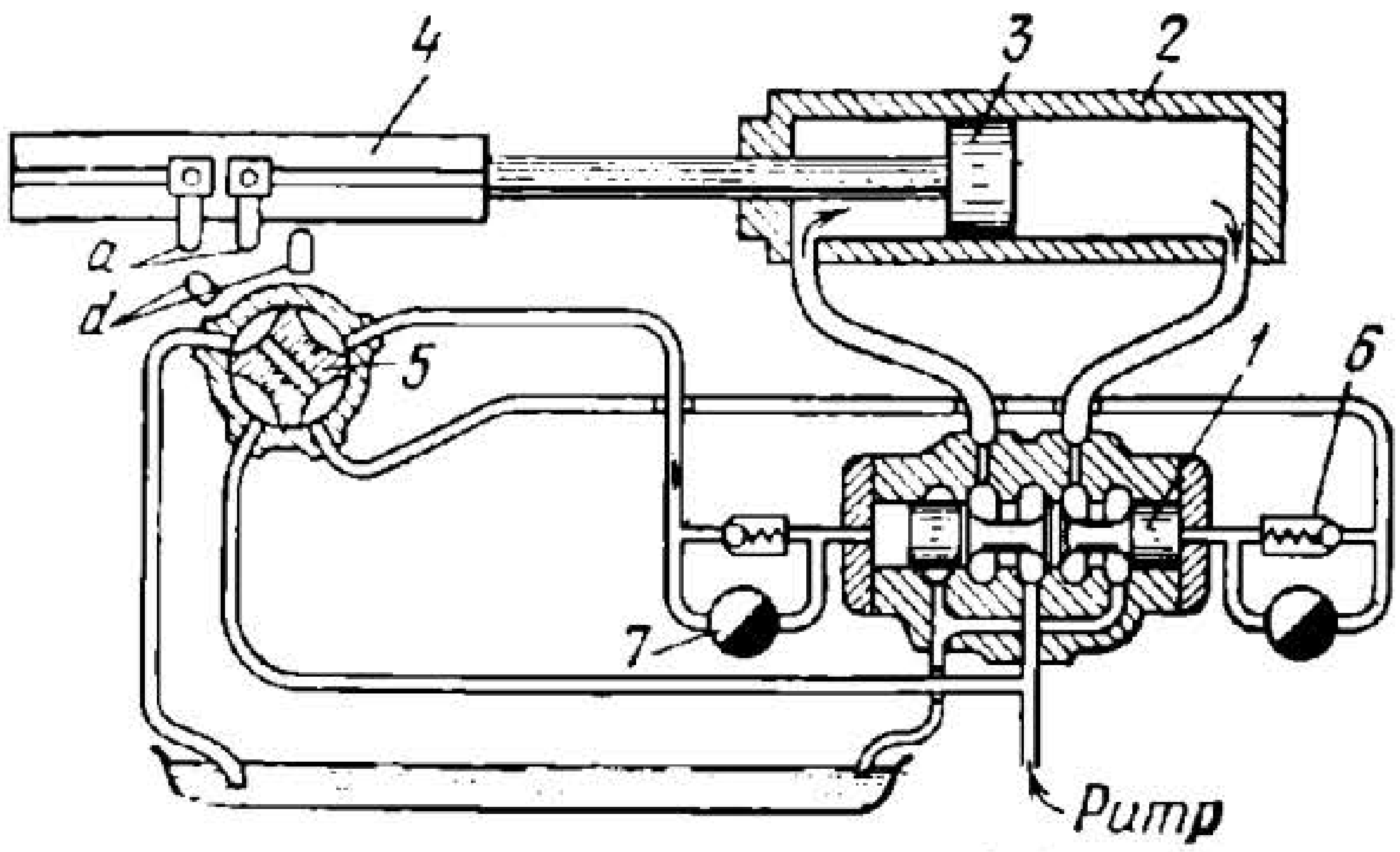
Constant-displacement pump *1* delivers fluid through pipeline *6* to chamber *a* and from there through pipeline *7* to the right end of power cylinder *2*, moving piston *5* to the left. Fluid from the left end of cylinder *2* is discharged to the tank. The pressure exerted by the fluid in chamber *a* on valve member *3* is counterbalanced by the action of spring *8* and the working pressure, transmitted through damping device *9*. If the working pressure begins to increase due to an increased load on piston *5*, valve member *3* shifts downward, reducing the opening between the cone of member *3* and seat *10*. This raises the pressure developed by pump *1* until an equilibrium is reached in the forces acting on valve member *3*. If the working pressure in cylinder *2* increases above the permissible value, ball valve *11* opens and fluid is discharged through passage *d* to the tank. As a result, valve member *3* moves upward and the pump is connected to the tank. The difference in pressure of the fluid entering and leaving flow-control valve *4* is maintained constant, ensuring a constant flow of fluid through the valve. The maximum permissible working pressure in the system can be regulated by changing the force exerted by spring *12* with regulating screw *13*.

4187	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A SPEED REGULATOR	CHP Dr



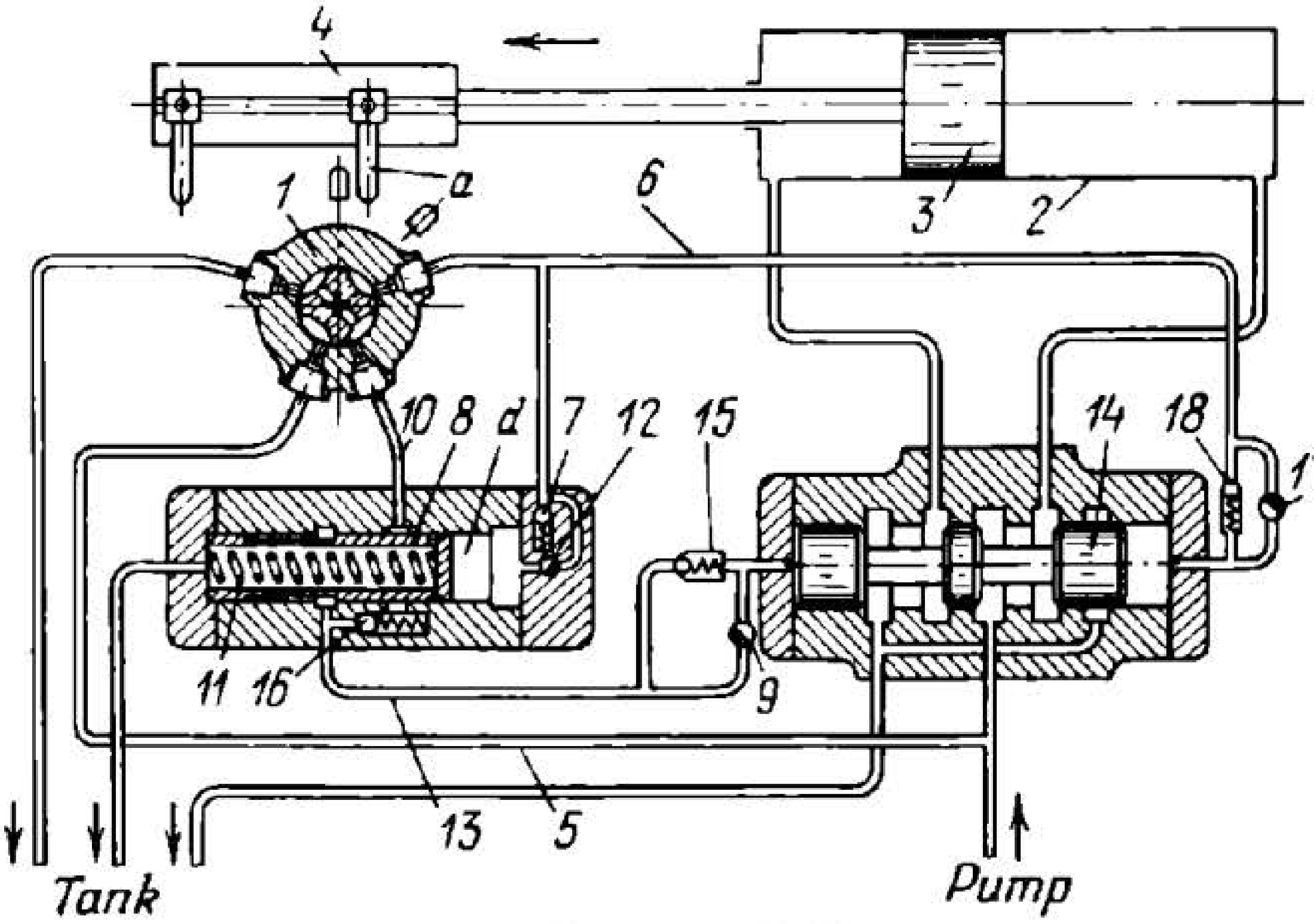
Pump *1* delivers fluid through flow-control valve *2* and the body of pressure reducing valve *3* to the right end of power cylinder *4*, moving piston *9* to the left. Fluid from the left end of the cylinder is discharged to the tank. A part of the fluid delivered by the pump passes through pipeline *5* into valve *3*, and through notch *a* of valve spool *6* to the tank. Chambers *d* and *b* are connected by passage *f*, drilled axially through spool *6*. Owing to the throttling of the fluid passing through notch *a*, the pressures in chambers *d* and *b* differ. By turning screw *7* it is possible to obtain almost complete equality of the forces acting on spool *6* from the two chambers. A constant pressure drop is maintained over flow-control valve *2* because, upon a change in pressure in the system, spool *6* is shifted either by the action of the changed pressure or that of spring *8*, thereby changing the amount of fluid discharged to the tank. Relief valve *10* protects the system against overloads.

4188	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



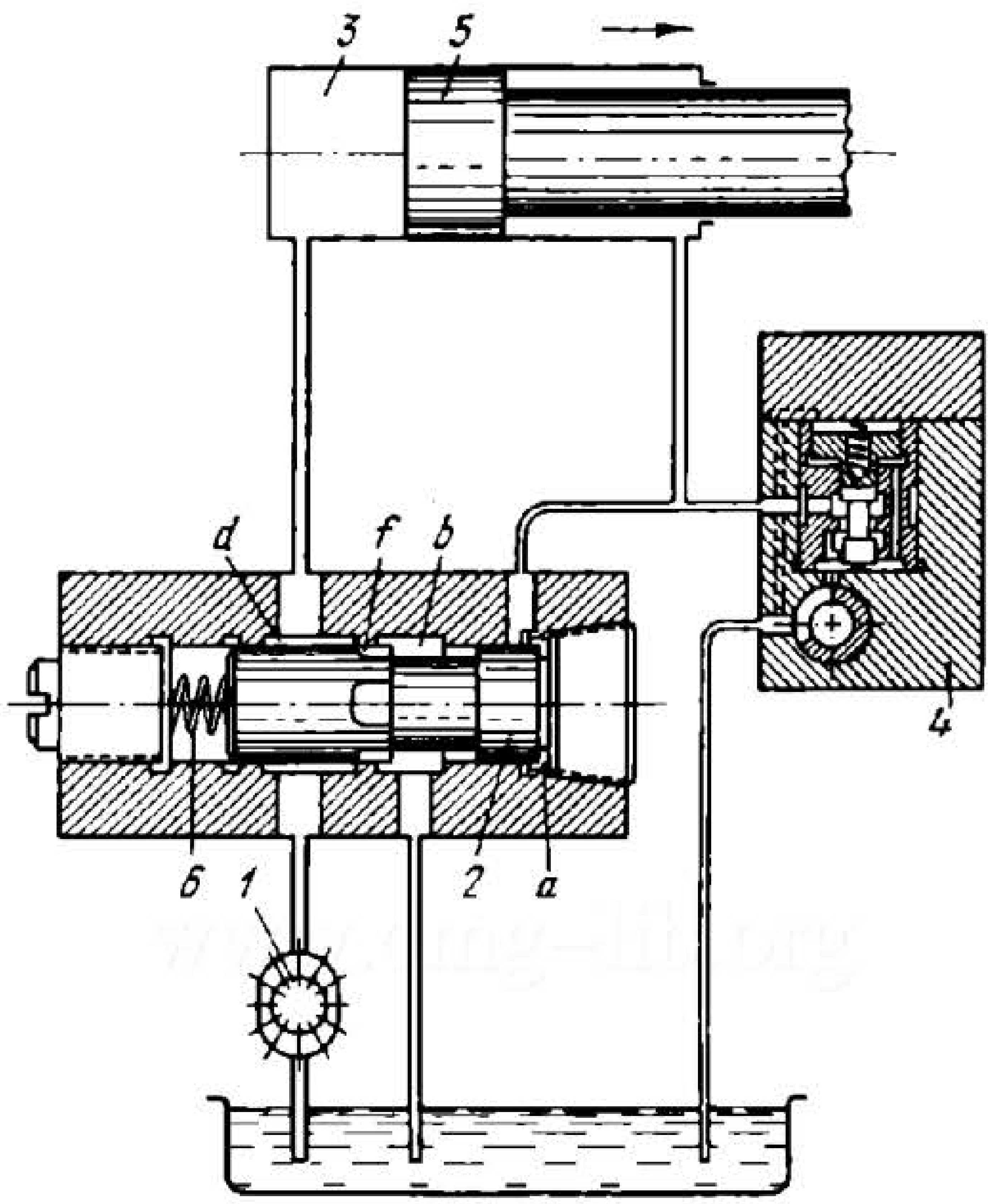
Fluid is delivered by the pump through the valve body and grooves of spool 1 to the left end of power cylinder 2, moving piston 3 and table 4, attached to the piston, to the right. From the right end of cylinder 2, fluid is discharged through the valve to the tank. Upon travel of the table, trip dogs *a*, mounted on the table, engage lugs *d* of rotary pilot valve 5, turning the valve member. A part of the fluid is delivered by the pump to this valve and further, opening ball check valve 6, shifts valve spool 1 to its extreme left-hand position. Fluid from the left end of spool 1 is discharged through flow-control valve 7 and valve 5 to the tank. After this, fluid is delivered by the pump to the right end of cylinder 2, moving piston 3 and table 4 to the left.

4189	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH A TIME RELAY	CHP Dr



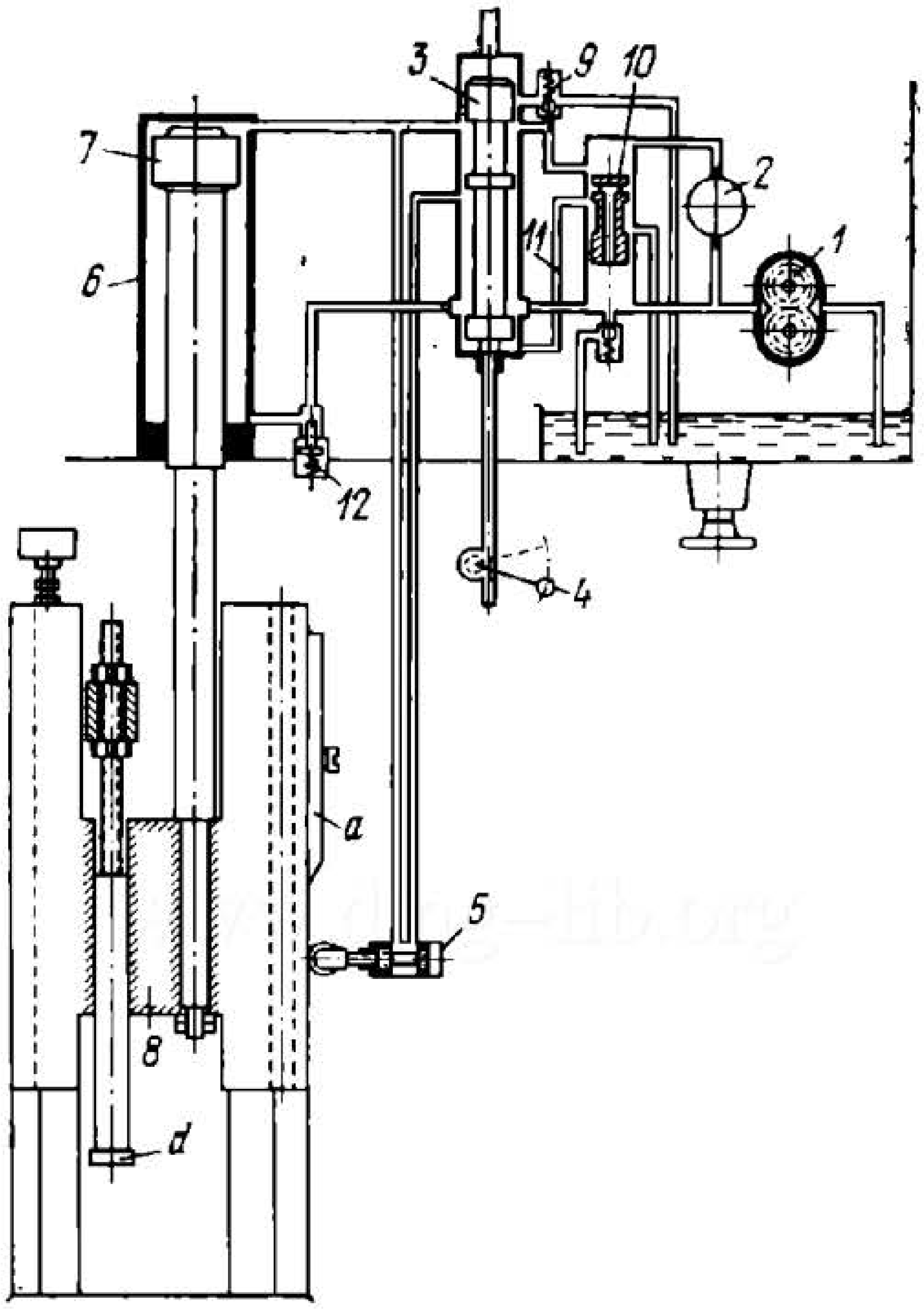
Fluid from the pump is delivered to the right end of cylinder *2*, moving piston *3* and table *4*, attached to the piston, to the left. The rotary pilot valve with member *1* connects delivery pipeline *5* to pipeline *6*. Fluid passing through the valve opens check valve *7* and shifts plunger *8* of the time relay to the extreme left position. Upon further travel of the table, trip dog *a*, mounted on the table, turns valve member *1* to its other position in which the delivery line is connected to pipeline *10* and pipeline *6* to the tank. Spring *11* moves plunger *8* to the right, discharging fluid from chamber *d* through flow-control valve *12* into pipeline *6*, and through the pilot valve to the tank. At the end of the stroke of plunger *8*, fluid from the delivery line passes through the pilot valve and pipeline *13* to the left end of valve spool *14*, after opening check valve *15*. Spool *14* is shifted by the pressure of the fluid to the right. Fluid from the right end of spool *14* is discharged through flow-control valve *17* and the pilot valve to the tank. Then the pump delivers fluid to the left end of cylinder *2*, moving piston *3* and table *4* to the right. Upon further motion of the table, valve member *1* is turned again by a trip dog of the table. Fluid from the delivery line passes through the pilot valve and time relay, opening check valve *18*, to the right end of valve spool *14*, shifting the spool to the left. Fluid from the left end of the spool is discharged through flow-control valve *9* and check valve *16*, and further through the time relay and pilot valve to the tank. The required time delay is set by regulating flow-control valve *12*.

MACHINE TOOL HYDRAULIC DRIVE MECHANISM



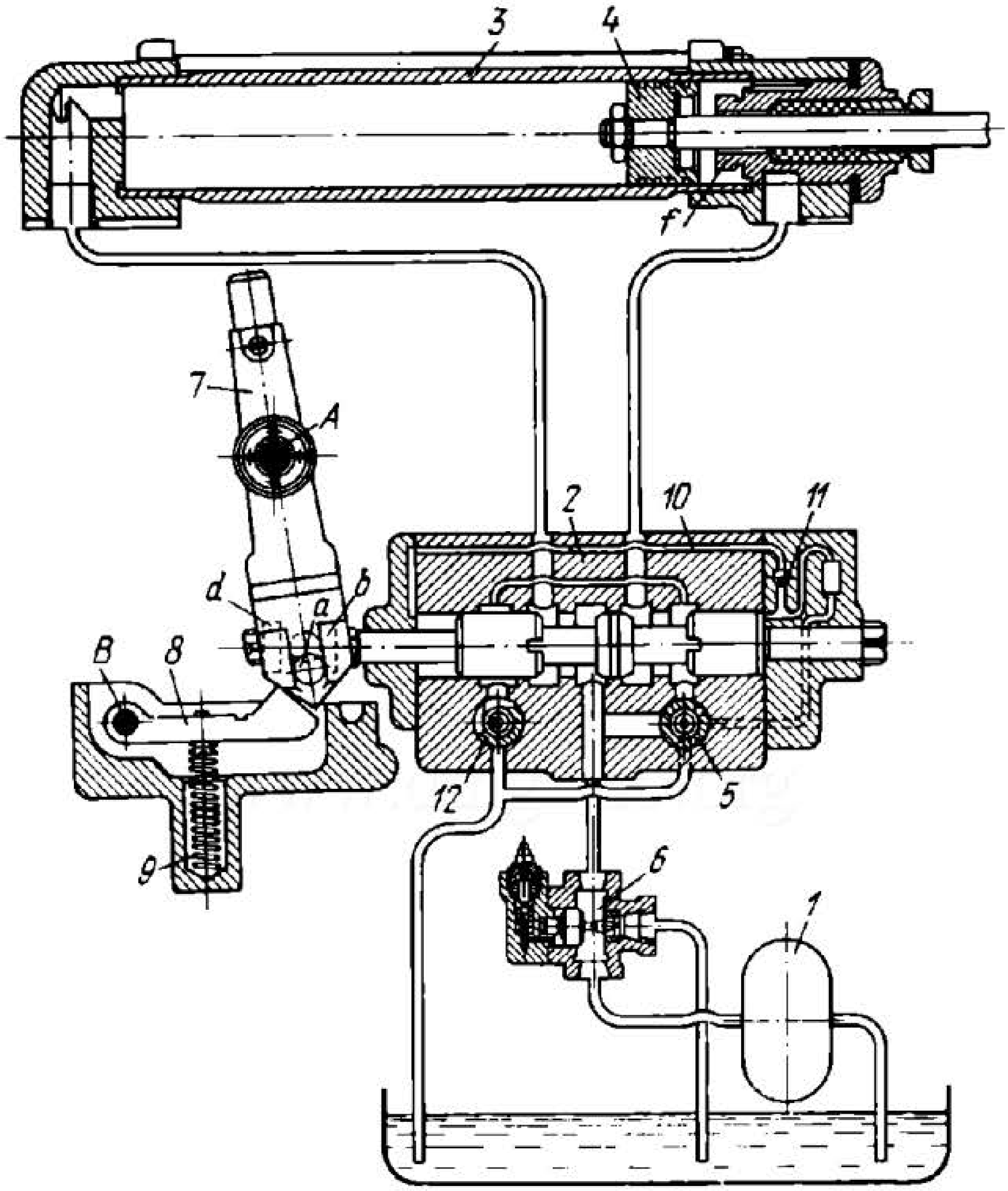
Pump *1* delivers fluid through a groove of valve spool *2* to the left end of cylinder *3*, moving piston *5* to the right. From the right end of cylinder *3*, fluid is discharged through speed regulator *4* to the tank. End *a* of spool *2* is connected to the right end of cylinder *3* so that the back pressure in the cylinder is transmitted to spool *2*. When the back pressure exceeds the design value, spool *2* shifts to the left, compressing spring *6* and connecting chambers *b* and *d*. At this, a part of the fluid delivered by the pump is discharged to the tank and the back pressure drops. Upon an increase in the load acting on piston *5*, the back pressure drops and spring *6* shifts spool *2* to the right. This increases the resistance to the flow of fluid from end *a* to chamber *b* because the clear opening, formed by notches *f* of spool *2*, is reduced. As a result, the working pressure increases to a value sufficient to overcome the resistance.

4191	HYDRAULIC DRIVE MECHANISM OF A SEMIAUTOMATIC CHUCKING MACHINE TOOLSLIDE	CHP Dr



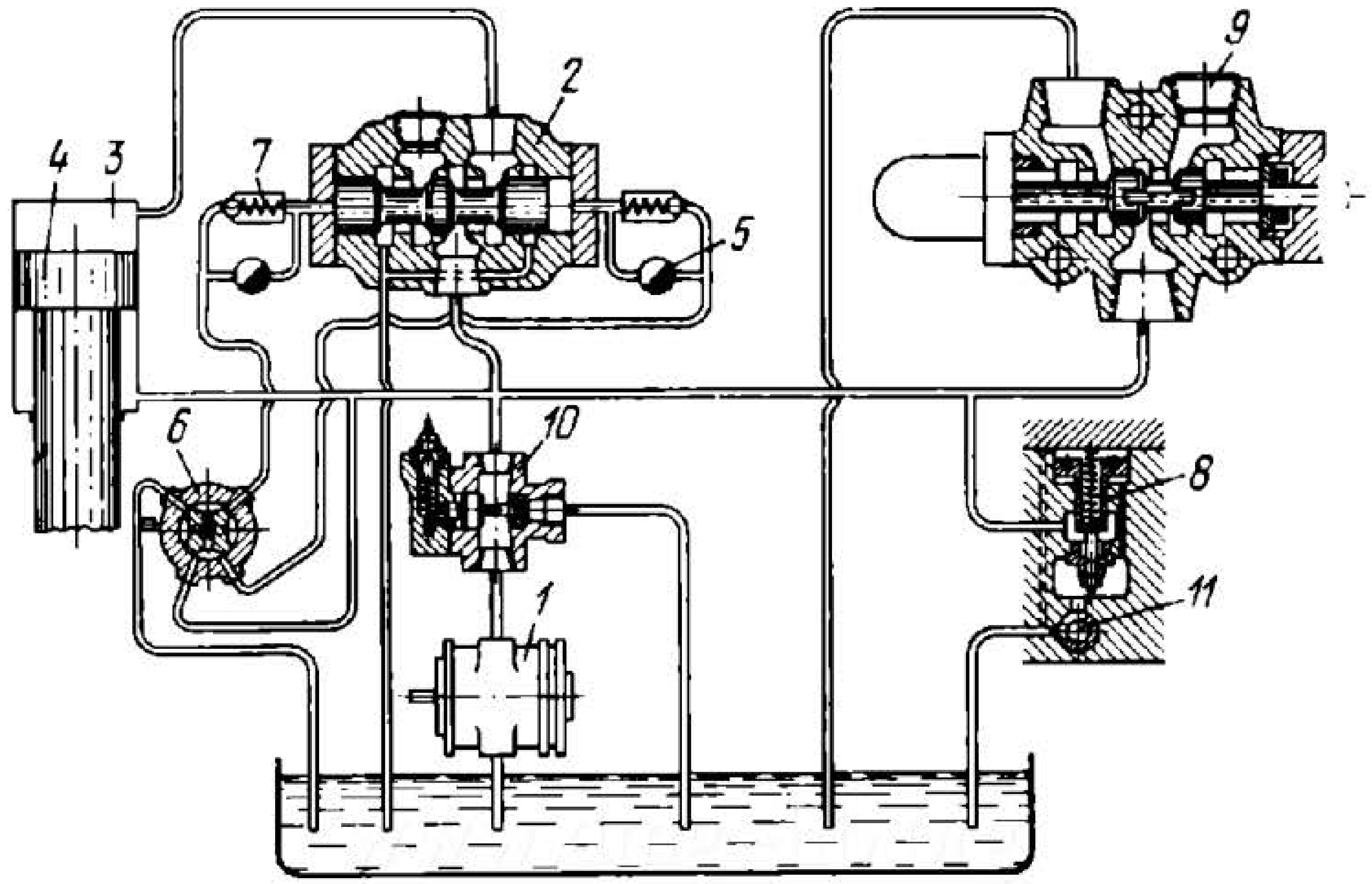
The hydraulic drive provides for rapid approach of the toolslide to the workpiece, working feed and rapid return upward. High-output gear pump *1* is used for rapid traverse. Variable-displacement piston pump *2* is used for the working feed. The working cycle is controlled by valve spool *3* which is shifted automatically or by hand using lever *4*. In the position shown, pumps *1* and *2* deliver fluid through a groove of valve spool *3* and through rapid traverse valve *5* to the upper end of power cylinder *6*. At this, the lower end of cylinder *6* is connected to the delivery line of pump *1*. The rod of piston *7* is rigidly attached to toolslide *8*. Owing to the action of the fluid, piston *7* and toolslide *8* travel rapidly downward. When cam dog *a* reaches valve *5*, the valve member is shifted, switching the system over to the working feed. The rate of feed of the toolslide is varied by changing the output of variable-displacement piston pump *2*. At the end of the working stroke, toolslide *8* runs up against positive stop *d*. Owing to the increase in pressure in the system, valve *9* is opened and through it fluid is discharged to the tank. At the same time, valve member *10* shifts downward, connecting the lower end of spool *3* through pipeline *11* to gear pump *1*. This shifts spool *3* upward and fluid is delivered by gear pump *1* to the lower end of working cylinder *6*. At this, the upper end of the cylinder is connected to the tank. Piston *7* and toolslide *8* are rapidly withdrawn upward. Relief valve *12* prevents the toolslide from moving down unintentionally due to its weight.

4192	MACHINE TOOL HYDRAULIC DRIVE MECHANISM WITH A REVERSING VALVE	CHP Dr



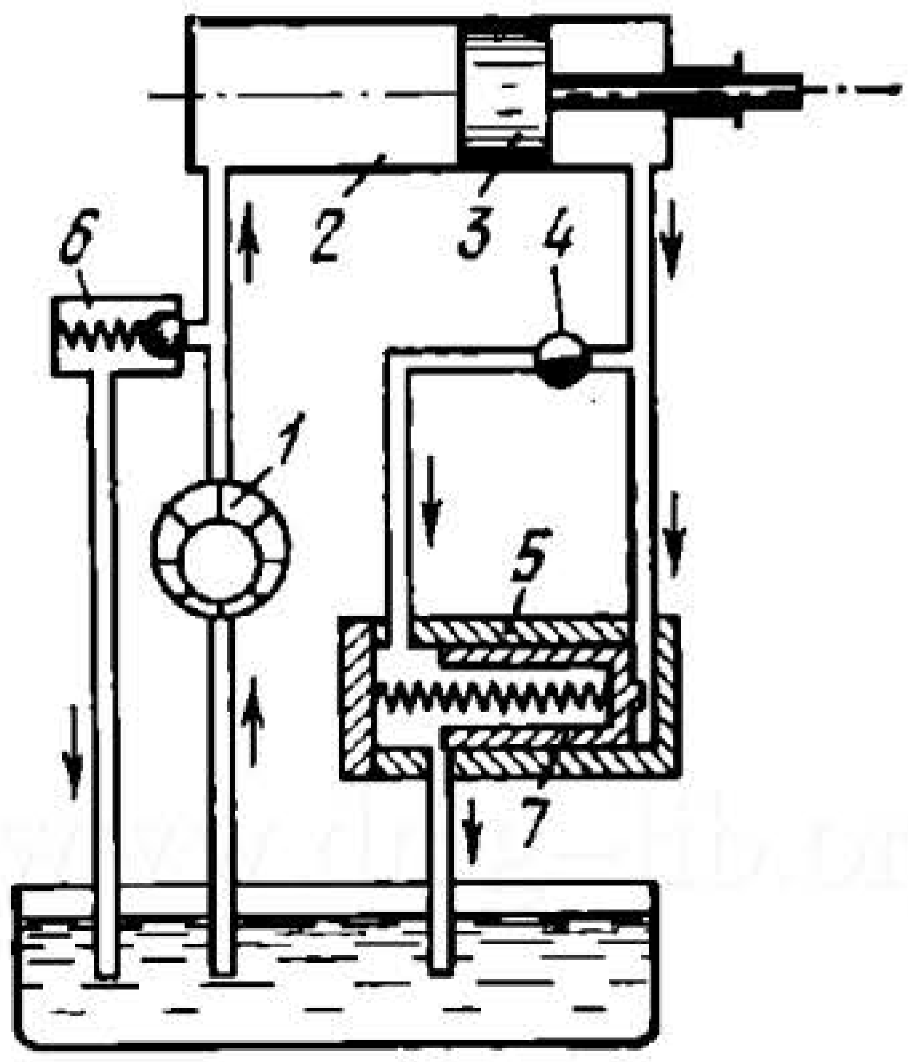
Pump *1* delivers fluid through directional valve *2* to the left end of power cylinder *3*, moving piston *4* to the right. Fluid from the right end of the cylinder is discharged through valve *2* and flow-control valve *5* to the tank. Relief valve *6* protects the system against overloads. A trip dog (not shown), mounted on the machine tool table, actuates lever *7* at the end of the piston stroke. Lever *7* turns about fixed axis *A*, turning latch *8* about fixed axis *B* and overcoming the resistance of spring *9*. When lever *7* reaches its vertical position, it is shifted by spring *9* to its other extreme position. Pin *a*, mounted on lever *7*, engages lugs *d* and *b* of the stem of the valve spool, shifting the spool to its extreme positions. At the moment the valve spool is shifted, the table is braked, fluid from the left end of the spool is delivered to the right end through passage *10* and flow-control valve *11*. This valve can be regulated to obtain the required velocity of motion of the valve spool, ensuring smooth table reversal. Piston *4* is braked in the extreme position because projection *f* of the cylinder enters a recess in the piston with a small clearance. Fluid passing through the clearance has a cushioning effect. The system can be started and stopped by turning valve *12* which, in stopping, connects the delivery system to the tank.

4193	MACHINE TOOL HYDRAULIC DRIVE MECHANISM	CHP Dr



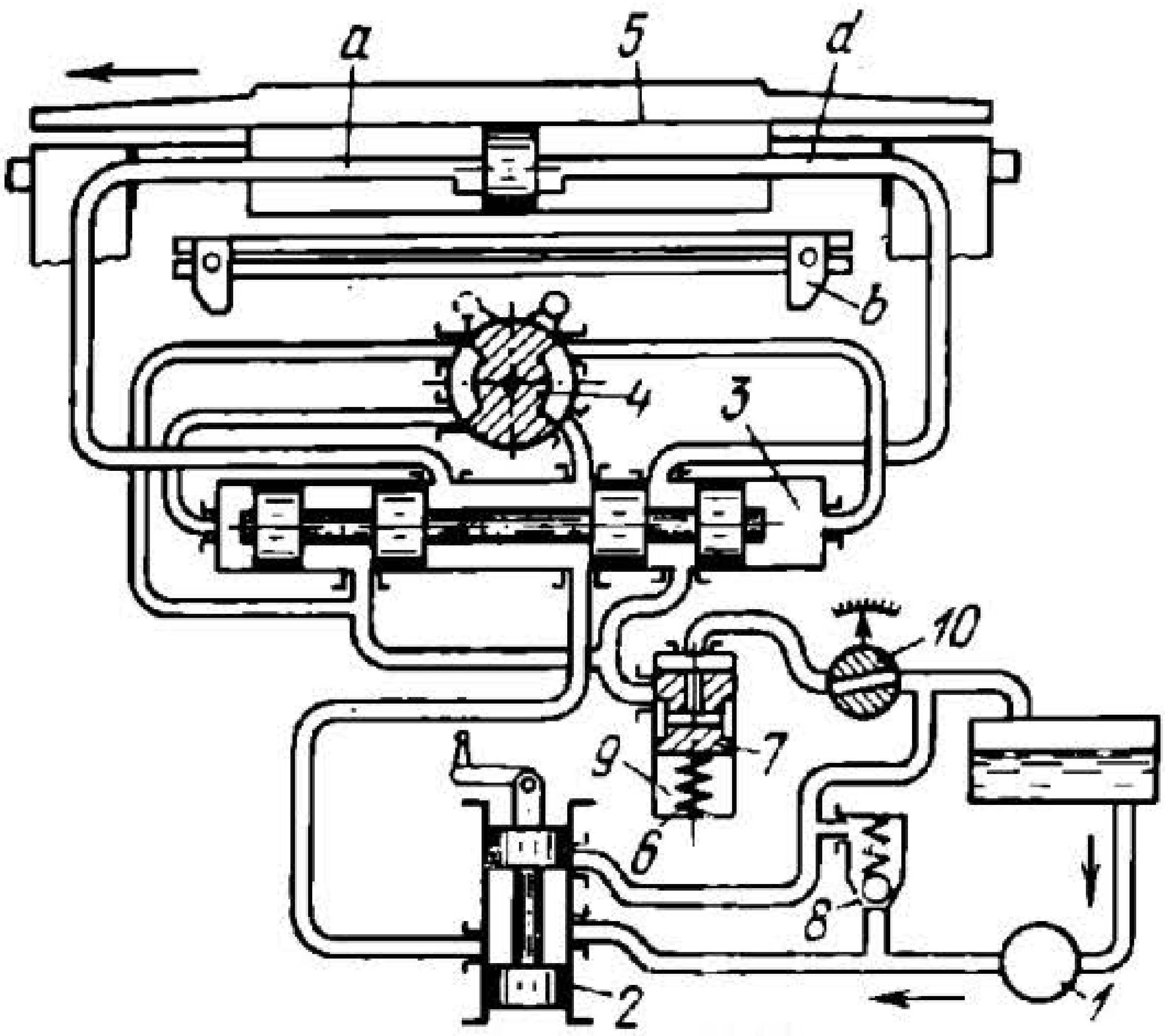
Pump *1* delivers fluid through pilot-operated directional valve *2* to the upper end of cylinder *3*, and piston *4* moves downward. The lower end of cylinder *3* is connected to the delivery line. Valve *2* is controlled by rotary pilot valve *6*. At the end of the stroke of piston *4*, a trip dog mounted on the travelling head of the machine tool turns valve *6*, and fluid under pressure from the delivery line passes through the valve and ball check valve *7* to the left end of valve *2*, shifting its spool to the right, while fluid from the right end of valve *2* drains through flow-control valve *5* and valve *6* back to the tank. In this position of the spool of valve *2*, fluid is delivered by the pump to the lower end of cylinder *3* and the upper end is connected through valve *2* to the tank. Piston *4* moves upward. The speed of piston *4* is varied by a speed regulator installed in the delivery line of the system and consisting of flow-control valve *11* and pressure reducing valve *8* which automatically maintains a constant pressure before valve *11*. The system is started and stopped by valve *9* which connects the delivery line to the tank to stop the machine tool. Relief valve *10* protects the system against overloads.

4194	HYDRAULIC DRIVE MECHANISM WITH DOUBLE FLUID THROTTLING	CHP Dr



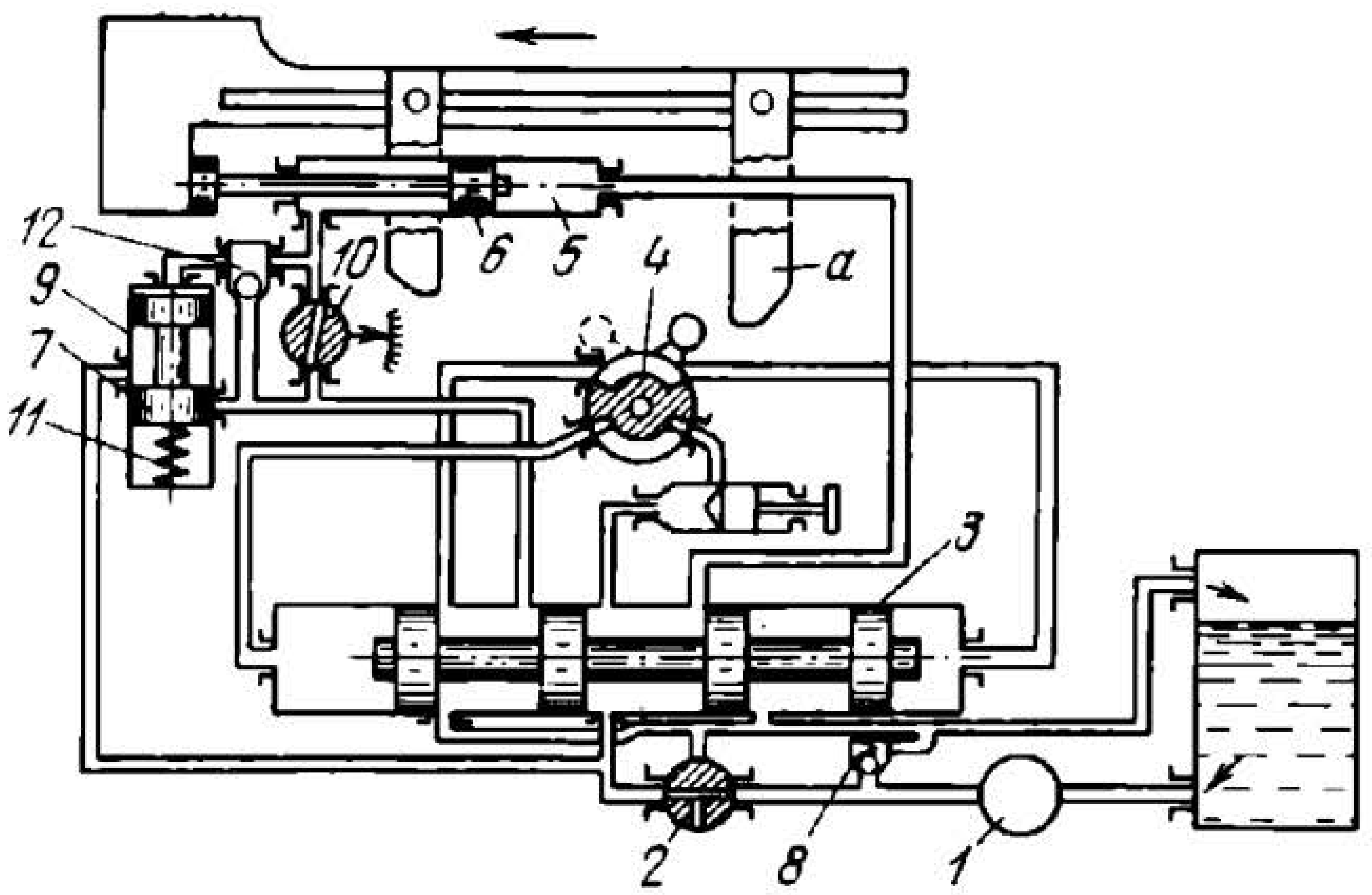
Pump *1* delivers fluid to the left end of cylinder *2*, moving piston *3* to the right. Fluid from the right end of cylinder *2* is discharged through flow-control valve *4* and valve *5* to the tank. Relief valve *6* maintains constant pressure in the delivery line. When the pressure increases in the right end of the cylinder and in the discharge pipeline, piston *7* of valve *5* moves to the left, increasing the pressure at the output from flow-control valve *4*. Thus, the pressure drop over valve *4* is maintained constant.

4195	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH DOUBLE FLUID THROTTLING	CHP Dr



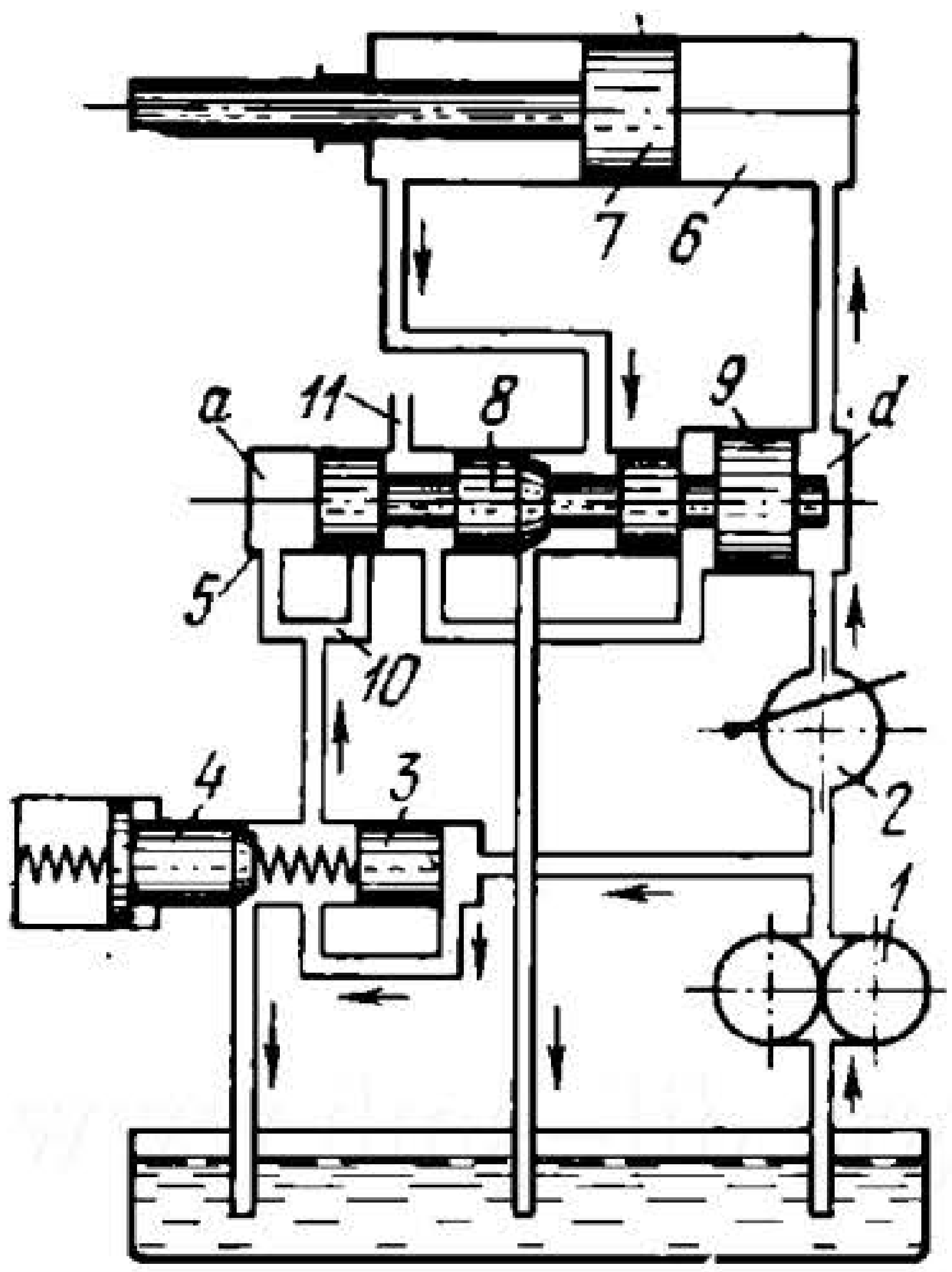
Pump *1* delivers fluid through starting valve *2*, directional valve *3*, controlled by reversing pilot rotary valve *4*, and passage *a* of the stationary piston rod to the left end of cylinder *5*, moving the cylinder to the left. In this case, the right end of valve *3* is connected to the delivery line. Fluid from the right end of cylinder *5* is discharged through passage *d* of the stationary piston rod, valve *3*, pressure reducing valve *9* and flow-control valve *10* to the tank. Fluid is admitted through side ports, radial and axial passages to the upper end of valve *9* and acts on plunger *7* which is subject underneath to the action of spring *6*. The higher the pressure in the upper end of valve *9*, the less the amount of fluid delivered to valve *10*, so that a low pressure is constantly maintained with little variation at the input to flow-control valve *10*. Relief valve *8* protects the system against overloads. As cylinder *5* travels to the left, trip dog *b*, mounted on the table, turns the lever of reversing valve *4*. This connects the left end of valve *3* to the delivery line, and the right end to the tank, shifting the spool of valve *3* to the right. Then fluid from the pump is delivered to the right end of cylinder *5*, moving it to the right. The drive provides for equal speeds of travel of the cylinder and table in both directions.

4196	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH DOUBLE FLUID THROTTLING	CHP Dr



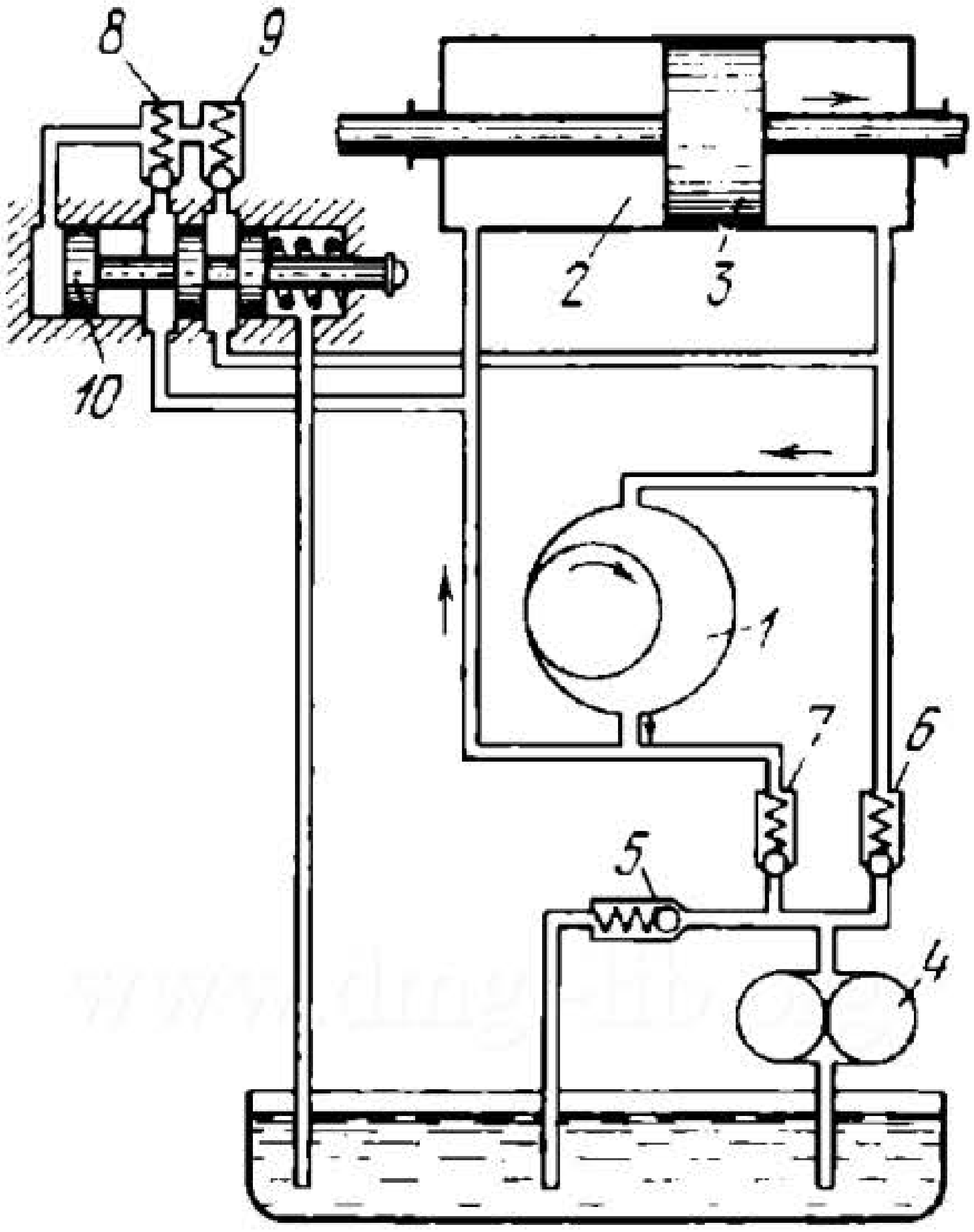
Pump *1* delivers fluid through starting valve *2* and directional valve *3*, controlled by reversing pilot rotary valve *4*, to the right end of cylinder *5*, moving piston *6* and the machine tool table, rigidly attached to the piston rod, to the left. Fluid from the left end of cylinder *5* is discharged through flow-control valve *10* and valve *3* to the tank. In this case, the left end of valve *3* is connected to the delivery line. Pressure reducing valve *9* automatically regulates the pressure before flow-control valve *10* and the speed of the table. The pressure in the discharge pipeline acts on the upper end of spool *7* against the action of spring *11*. Upon an increase inspeed and, consequently, in pressure before valve *10*, spool *7* moves downward and by-passes a part of the fluid from the delivery line to the tank, thereby reducing the speed. When the pressure drops, spool *7* moves upward, reducing the amount of fluid by-passed to the tank and maintaining the preset speed. As the table travels to the left, trip dog *a*, mounted on the table, turns the lever of reversing valve *4*. This connects the right end of valve *3* to the delivery line, and the left end to the tank, shifting the spool of valve *3* to the left. Then fluid is delivered by the pump to the left end of cylinder *5*, through check valve *12*, by-passing flow-control valve *10* and pressure reducing valve *9*. At this, piston *6* and the table travel rapidly to the right (rapid return stroke). Relief valve *8* protects the system against overloads.

4197	HYDRAULIC DRIVE MECHANISM WITH TWO PUMPS	CHP Dr



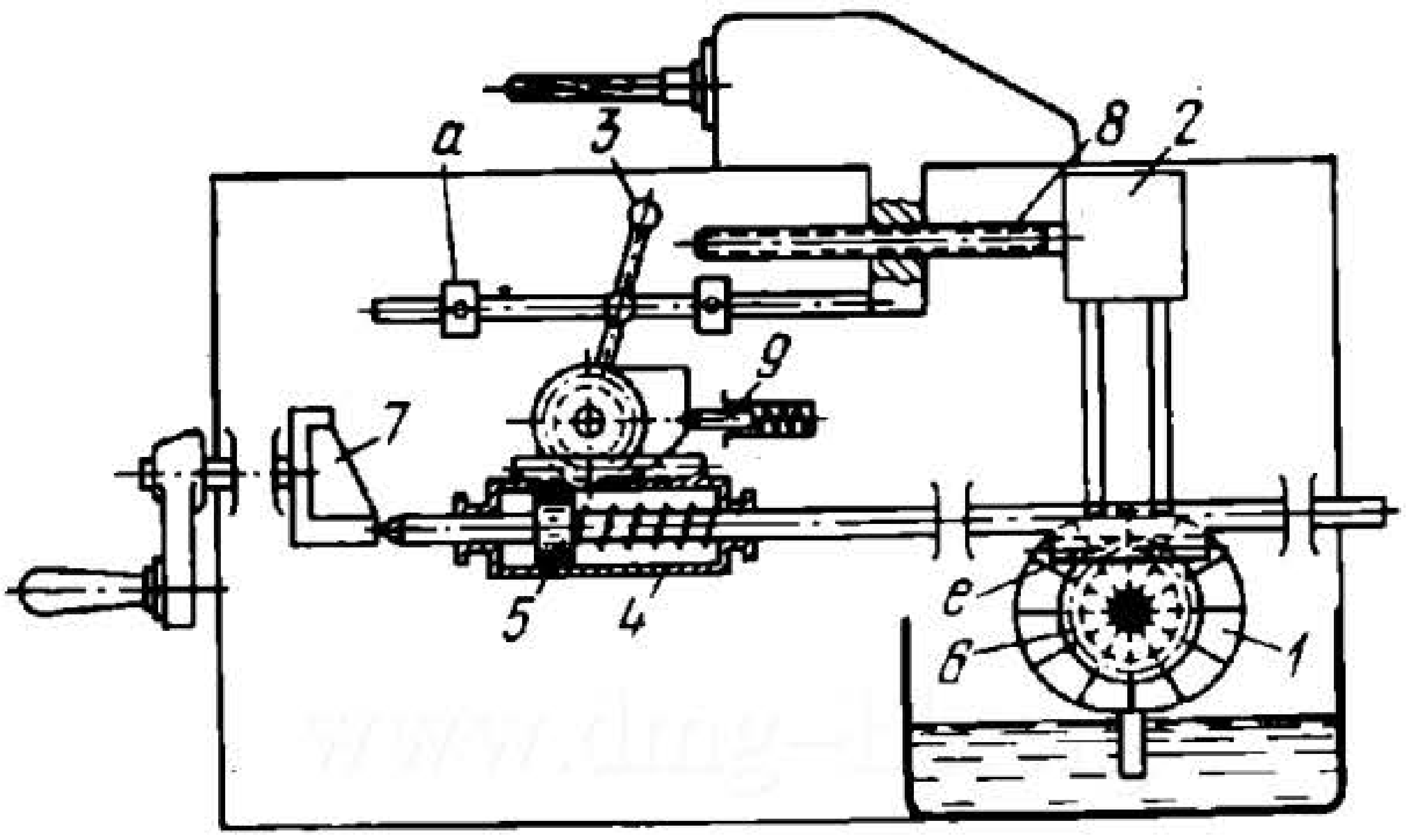
Gear pump *1* delivers fluid to variable-displacement pump *2*. Surplus fluid is discharged through valves *3* and *4* to the tank. End *a* of directional valve *5* is connected to the delivery line of gear pump *1*. Pump *2* delivers fluid to the right end of power cylinder *6* through valve *5* at whose end *d* the pressure is equal to that developed by variable-displacement pump *2*. Piston *7* is moved by the fluid to the left. Fluid from the left end of cylinder *6* is discharged to the tank after being throttled through the opening formed by the taper of land *8* of the spool of valve *5*. Land *9* is of larger diameter than land *8*. The spool with lands *8* and *9* is shifted in accordance with the pressure difference at its ends. When piston *7* stops at the end of its working stroke, the pressure in the right end of the cylinder increases and the spool of valve *5* shifts to the left, so that fluid under pressure from pipeline *10* passes through pipeline *11* to a valve (not shown) which reverses the stroke of piston *7*.

4198	HYDRAULIC DRIVE MECHANISM WITH TWO PUMPS	CHP Dr



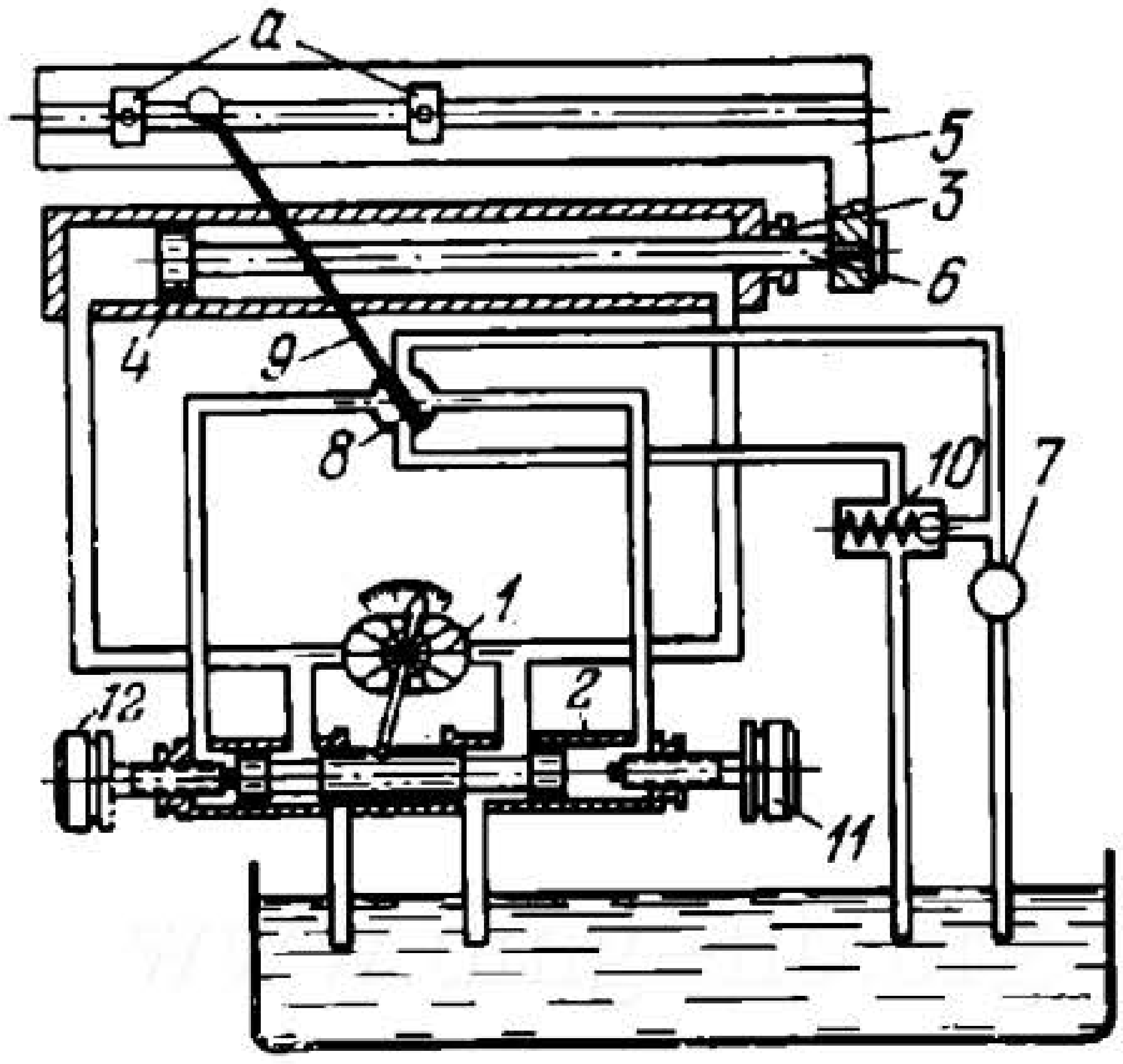
Variable-displacement pump 1 delivers fluid to the left end of power cylinder 2, moving piston 3 to the right. Fluid from the right end of cylinder 2 is returned to the pump. The speed of piston 3 is varied and it is reversed by displacing the stator of pump 1. Gear pump 4 provides make-up fluid to compensate for leakage in the system. Overflow valve 5 is always open. Leakage in the system is compensated for through check valve 6 or 7, depending upon the direction of motion of piston 3. In the position shown, leakage is compensated for through valve 6, valve 7 being closed by the high pressure in the left end of cylinder 2. Upon overloads or excessive increase in pressure, valve spool 10 is shifted to the right by the opening of check valve 8 or 9, thereby connecting the delivery and suction pipelines. Consequently, if piston 3 is stopped, pump 1 operates at low pressure.

4199	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL WITH AUTOMATIC STROKE REVERSAL	CHP Dr



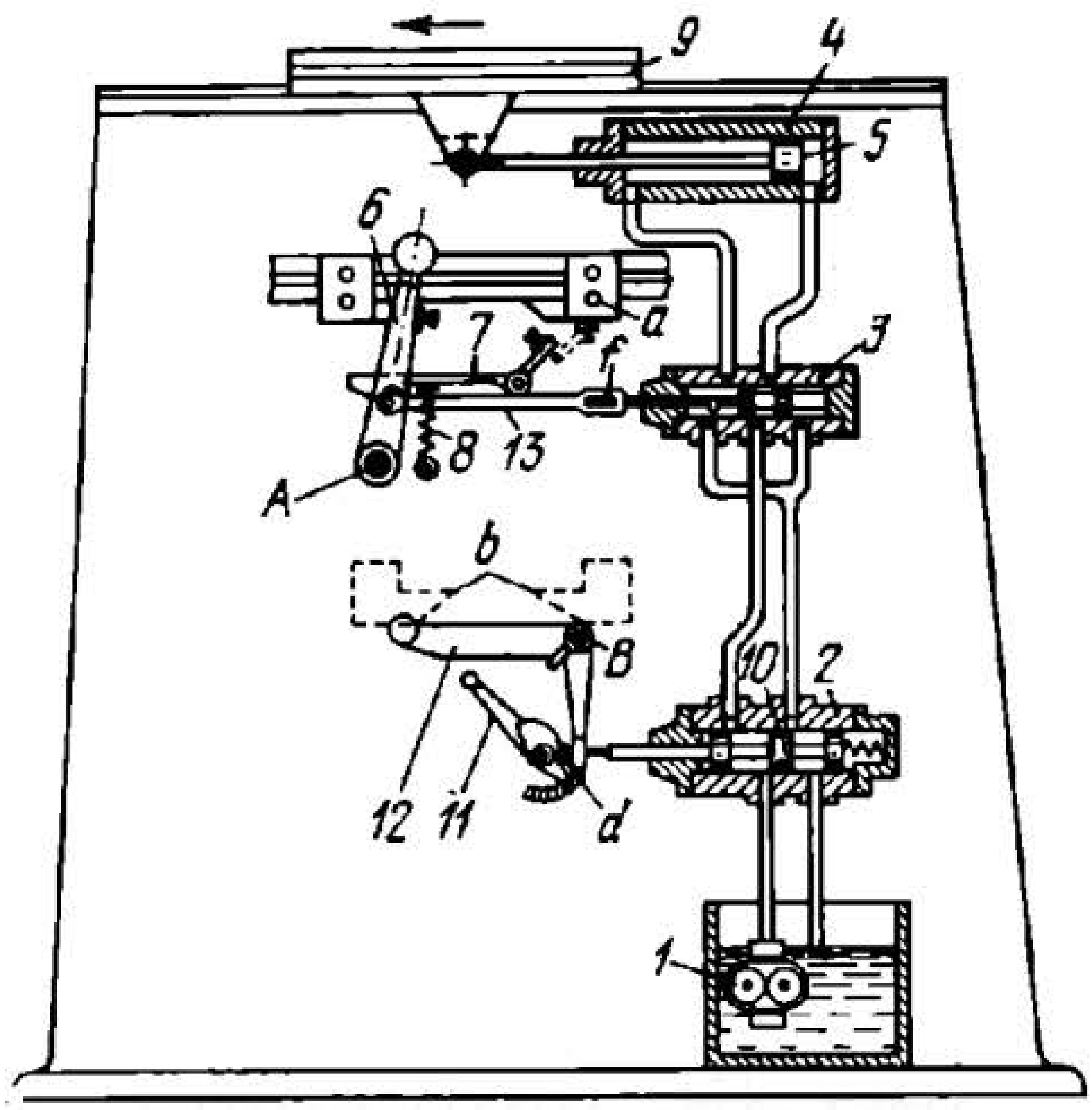
Reversible pump *1* delivers fluid from the tank to hydraulic motor *2* which rotates lead screw *8*, linked to the rotor of motor *2*. This feeds the drill head along the base ways. As the head travels, its trip dogs *a* turn reversing lever *3* together with a pinion attached to the lever. The pinion meshes with the gear rack of cylinder *4*. As cylinder *4* moves to the right, the increased pressure in its left end moves piston *5* to the right. Gear rack *e* on the rod of piston *5* turns pinion *6* which is linked to the regulating lever of pump *1*. In turning, the lever reverses pump *1* and the rotor of motor *2* begins to rotate in the reverse direction. This reverses the travel of the drill head. Cam *7* varies the rate of feed of the drill head. Detent *9* indexes the positions of lever *3*.

4200	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH AUTOMATIC STROKE REVERSAL	CHP Dr



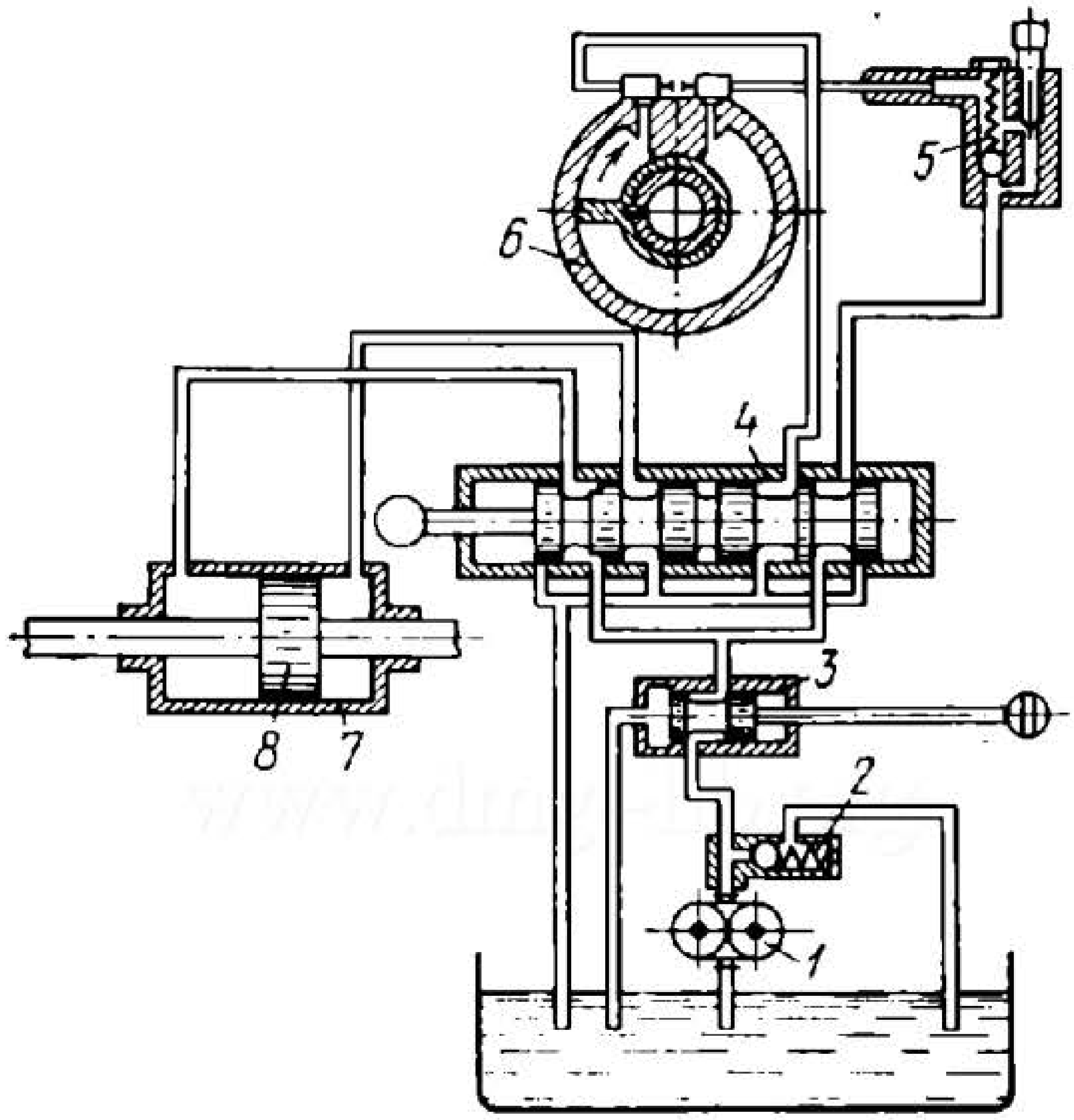
Reversible pump *1* delivers fluid from the tank through directional valve *2* to the left end of power cylinder *3*, moving piston *4* and table *5*, rigidly attached to piston rod *6*, to the right. The delivery line of gear pump *7* is connected through reversing rotary pilot valve *8* to the right end of valve *2* whose spool is in its extreme left-hand position. As piston *4* travels to the right, trip dogs *a* turn lever *9* of reversing valve *8* clockwise. At this fluid from pump *7* is delivered to the left end of valve *2*, shifting its spool to the right. The right end of the valve is connected to the tank. When the spool of valve *2* reaches its extreme right-hand position, fluid is delivered by the pump to the right end of power cylinder *3*, moving piston *4* and table *5* to the left. Relief valve *10* protects the system against overloads. Adjusting screws *11* and *12* regulate the speed of the forward and return strokes of the table.

4201	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE WITH SMOOTH VALVE ACTION	CHP Dr



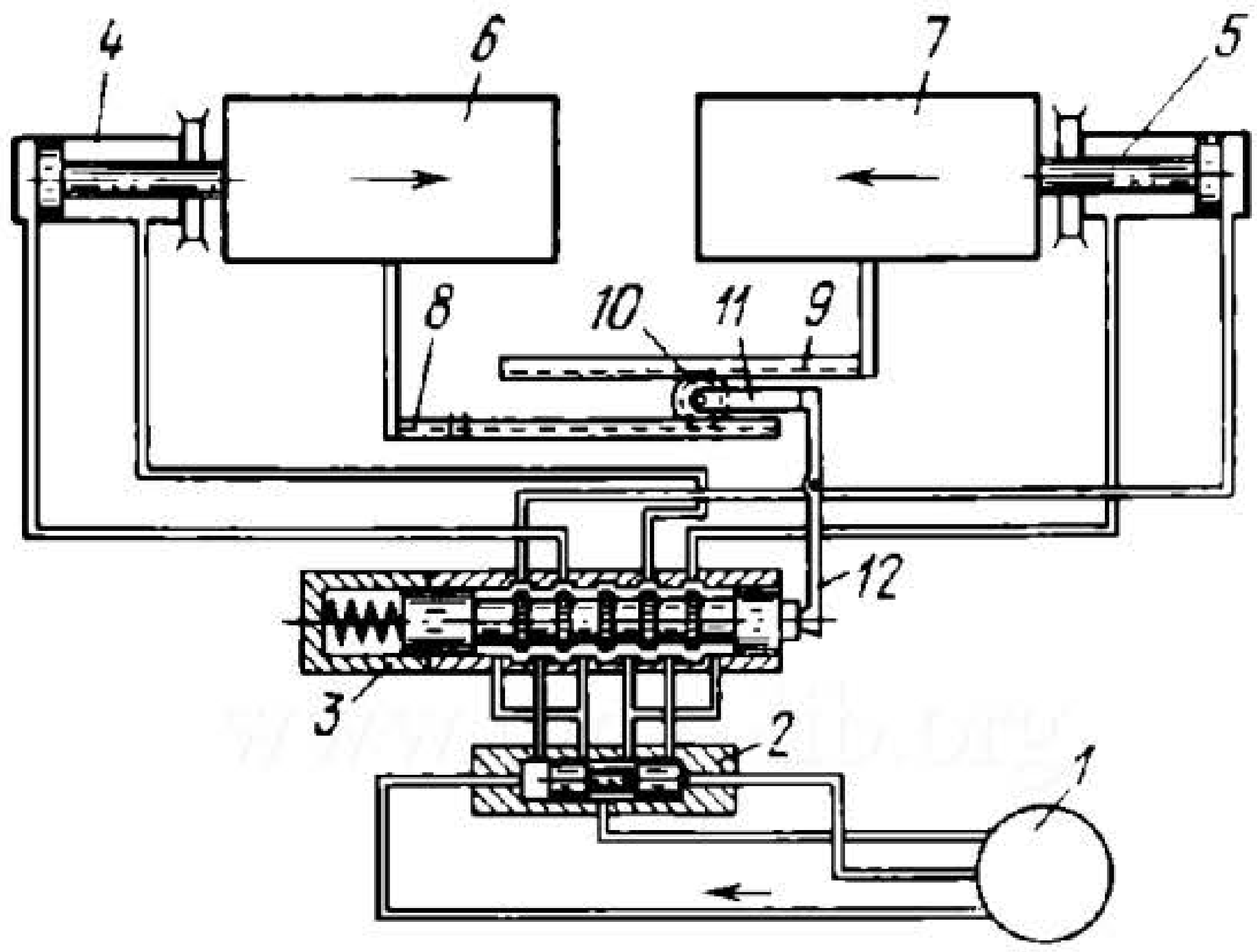
Pump *1* delivers fluid through flow-control valve *2* and directional valve *3* to the right end of cylinder *4*, moving piston *5* and table *9*, rigidly attached to the piston rod, to the left. From the left end of cylinder *4*, fluid is discharged through valve *3* and flow-control valve *2* to the tank. At the end of the table stroke, pin *a*, mounted on the table, turns reversing lever *6* counterclockwise about fixed axis *A*. At this, tie-rod *13*, linked to lever *6* and with slot *f* linked to the spool of valve *3*, shifts the spool to the left. Owing to slot *f* in the tie-rod, lever *6* does not at first shift the spool of valve *3*, but, with its prismatic lug, turns lever *7*. When the apex of the lug of lever *6* passes the apex of the lug on lever *7*, lever *6* is thrown over by spring *8*, shifting the spool of valve *3* to the left. Then fluid is delivered to the left end of cylinder *4*, moving piston *5* and table *9* to the right. The amount of fluid passing through flow-control valve *2* is regulated by spool *10* which is held by a spring with its stem head *d* against a cam rigidly attached to lever *11*. Lever *11* serves to set the required table speed. Spool *10* throttles the fluid in the delivery line and in the discharge line. The clear opening can be varied by turning lever *11*. At the end of the table stroke, one cam dog *b* engages the roller of bell-crank lever *12*, turning about fixed axis *B*, and moves spool *10* to the right, reducing the table speed at the end of its stroke. This provides for smooth valve action.

4202	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL TABLE	CHP Dr



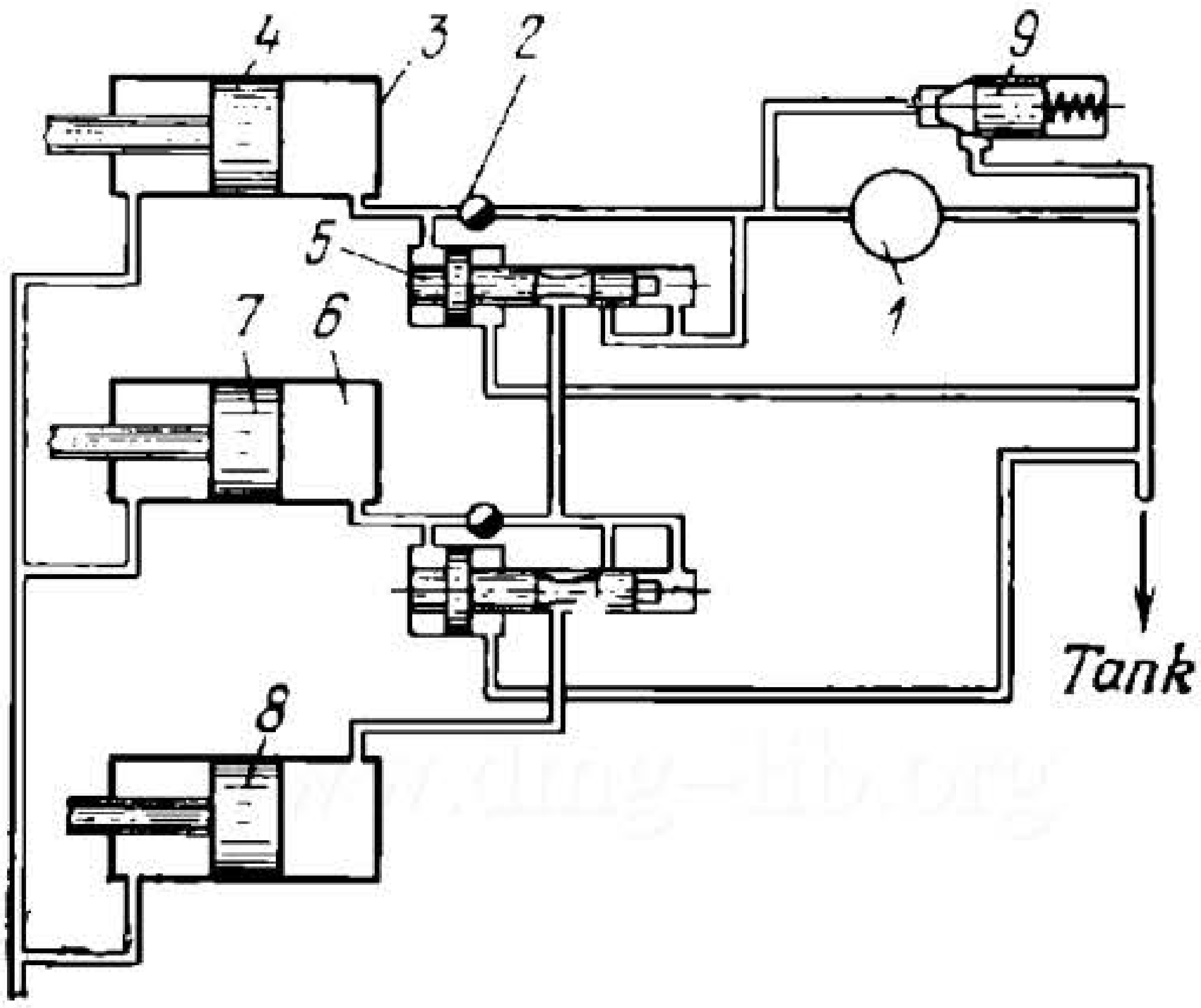
Pump *1* delivers fluid under pressure through starting valve *3* to a groove of the spool in directional valve *4*. From here a part of the fluid is delivered through ball check valve *5* to rotary actuator *6*, turning its shaft clockwise. The remainder of the fluid is delivered to the left end of cylinder *7*, moving piston *8* to the right. Fluid from the exhaust chamber of actuator *6* and the right end of cylinder *7* passes through valve *4* to the tank. Valve *4* is controlled by trip dogs mounted on the machine tool table. When its spool is shifted to the right, the actuator and the piston of the hydraulic cylinder are reversed.

4203	HYDRAULIC DRIVE MECHANISM OF A MACHINE TOOL WITH SYNCHRONIZED MOTION OF TWO PISTONS	CHP Dr



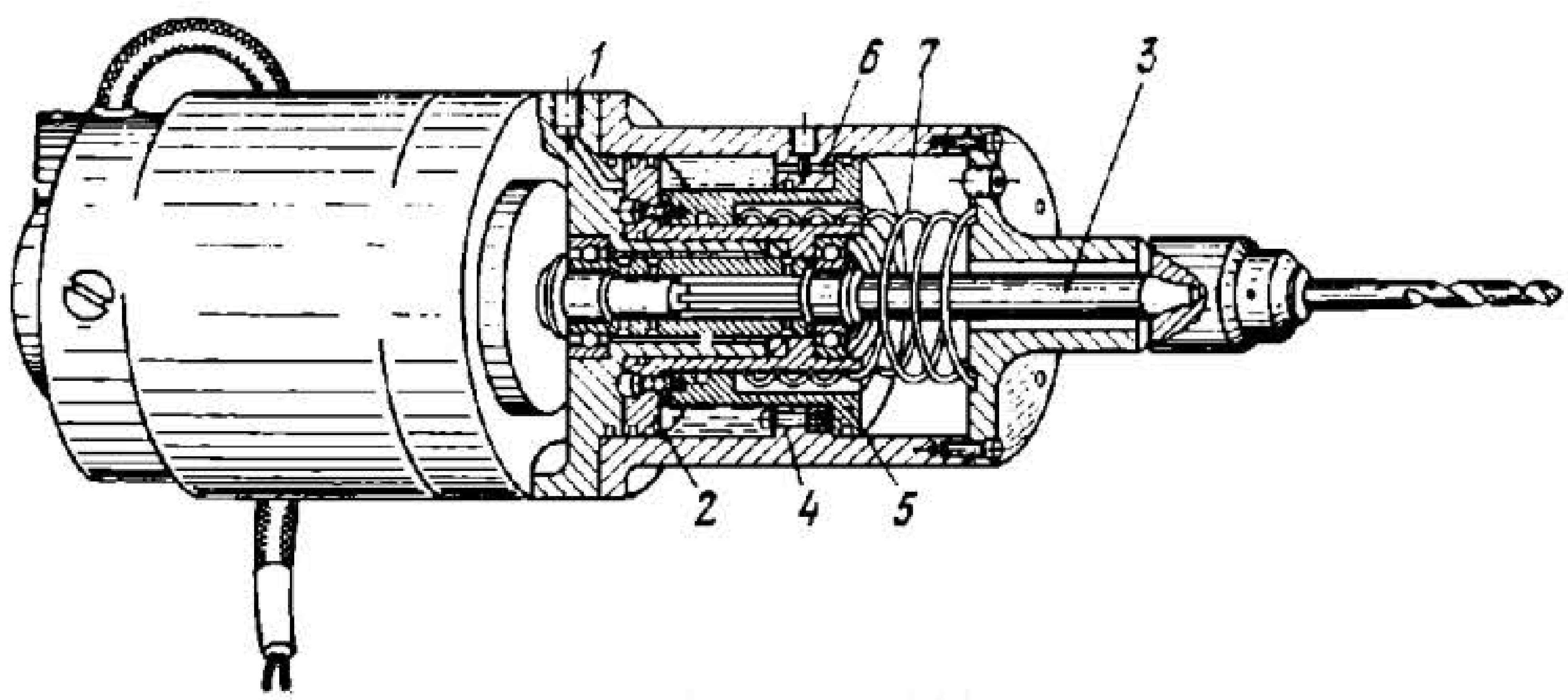
Pump *1* delivers fluid through starting valve *2* and directional valve *3* to power cylinders *4* and *5* with pistons linked to slides *6* and *7*. Slides *6* and *7* are linked together by gear racks *8* and *9*, and pinion *10*, meshing with both racks. Linked to the axle of pinion *10* is rod *11* which, upon unequal feed of the slides, turns lever *12*. This shifts the spool of valve *3* so that a greater amount of fluid is delivered to the cylinder whose piston is linked to the slide that lags behind, and a lesser amount to the other cylinder, thereby equalizing the rates of feed of the slides.

4204	SEQUENTIAL HYDRAULIC DRIVE MECHANISM FOR THREE OPERATIVE MEMBERS OF A MACHINE TOOL	CHP Dr



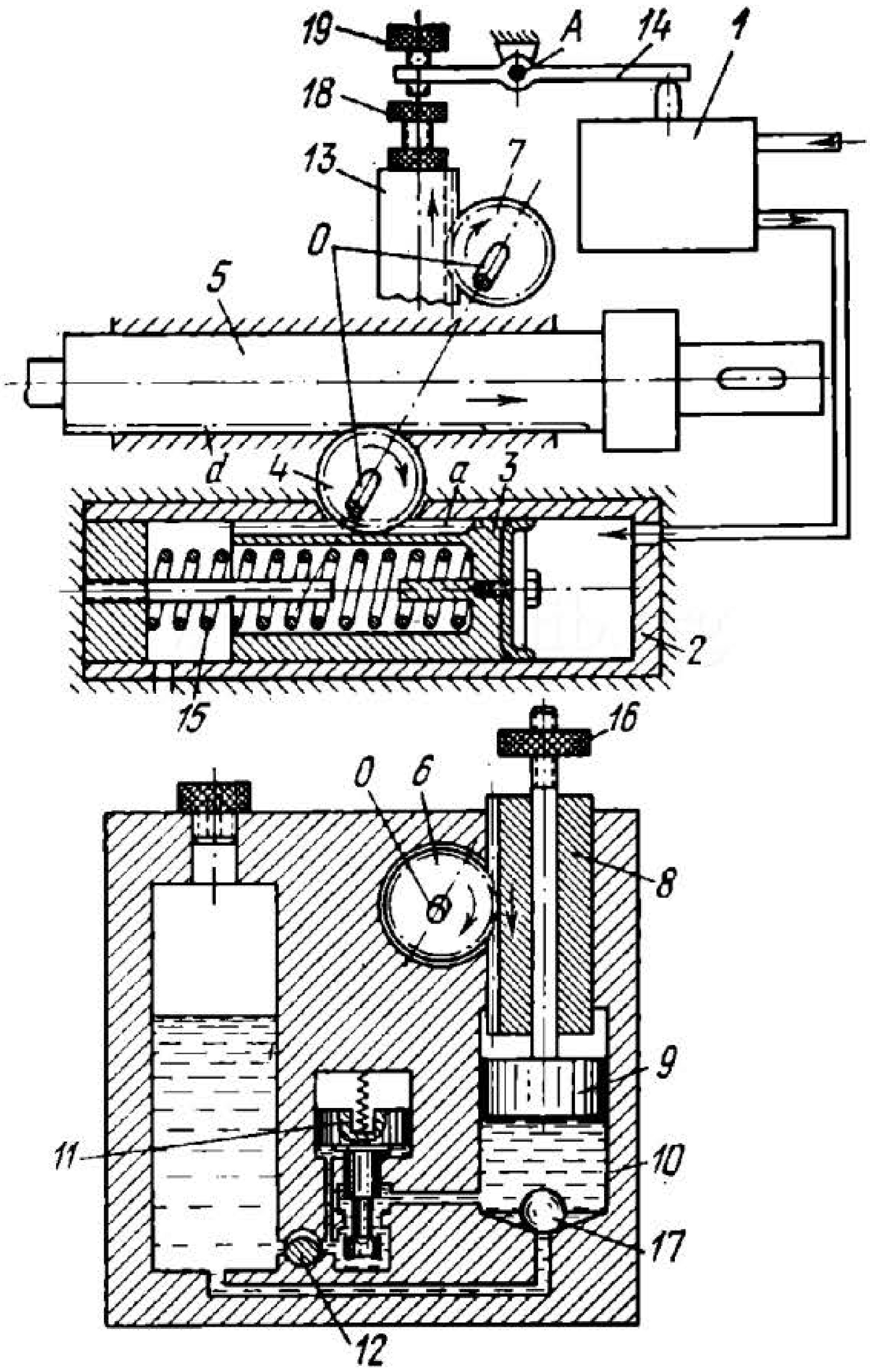
Pump 1 delivers fluid through flow-control valve 2 to the right end of cylinder 3, moving piston 4 to the left. At this, the spool of valve 5 is in the position shown. At the end of the stroke of piston 4, when it stops, the pressure increases in the left end of valve 5, shifting the spool to the right and connecting the delivery line of pump 1 to the right end of cylinder 6. When piston 7 has moved to the left and stops, the pump begins to deliver fluid to cylinder 8. The pistons and valve spools are returned to the initial position by a special arrangement (not shown). Relief valve 9 protects the system against overloads.

4205	HYDROPNEUMATIC SPINDLE FEED MECHANISM	CHP Dr



When compressed air is delivered to port *1*, piston *2* is advanced by the air pressure with spindle *3* to the work. Hydraulic fluid is forced out from the other side of the piston through valve *4* which is closed after piston *5* has advanced a certain distance. After valve *4* is closed, the hydraulic fluid can escape only through flow-control valve *6*, whose clear opening regulates the rate of spindle feed. After machining the work, port *1* is connected to the atmosphere. Then spring *7* returns pistons *2* and *5* rapidly to the initial position, retracting the spindle. The hydraulic fluid is forced back into the left chamber through check valve *4* which is opened by the pressure of the fluid.

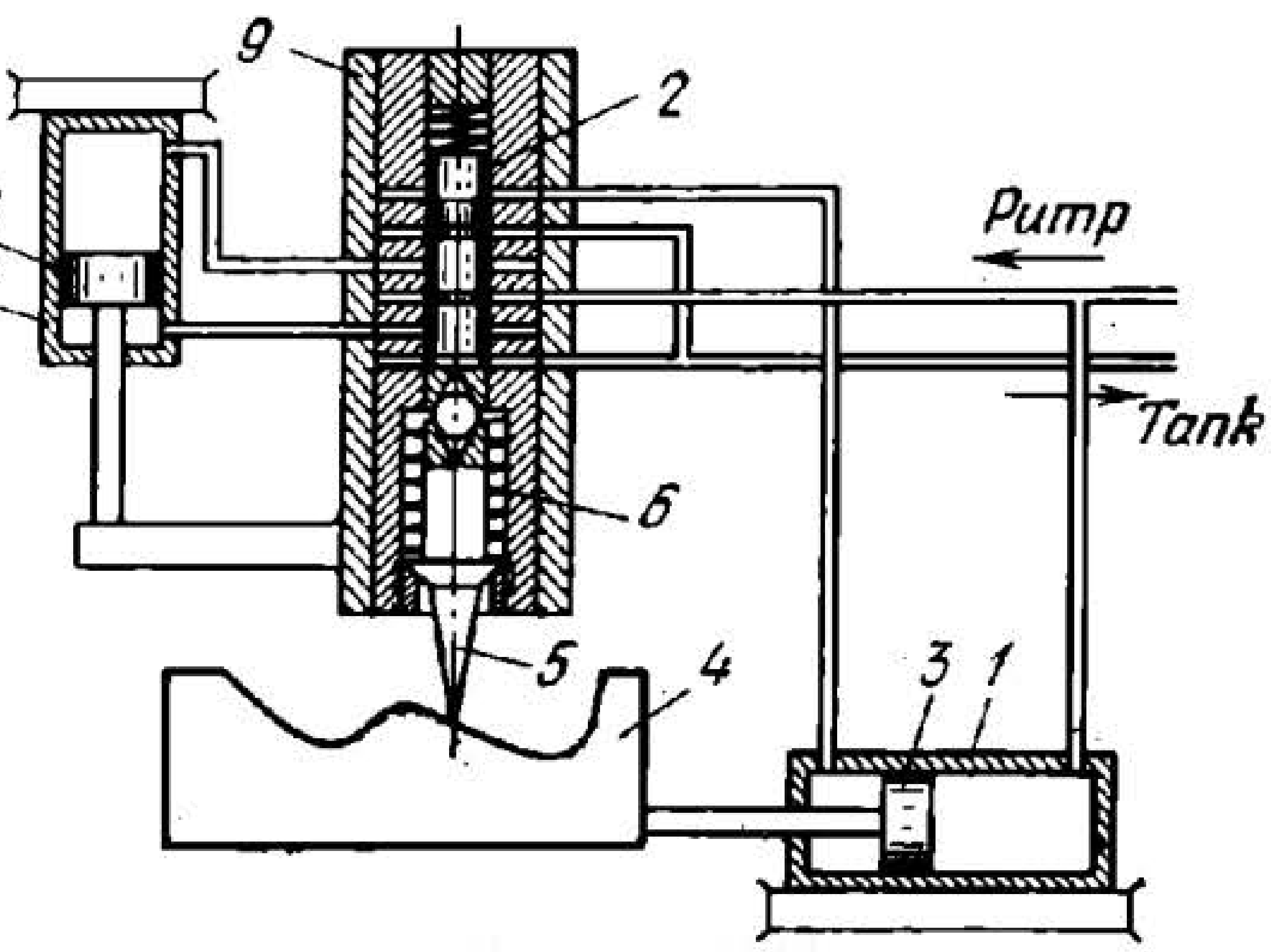
4206	HYDROPNEUMATIC DRIVE MECHANISM OF A MACHINE TOOL	CHP Dr



4206	HYDROPNEUMATIC DRIVE MECHANISM OF A MACHINE TOOL	CHP Dr

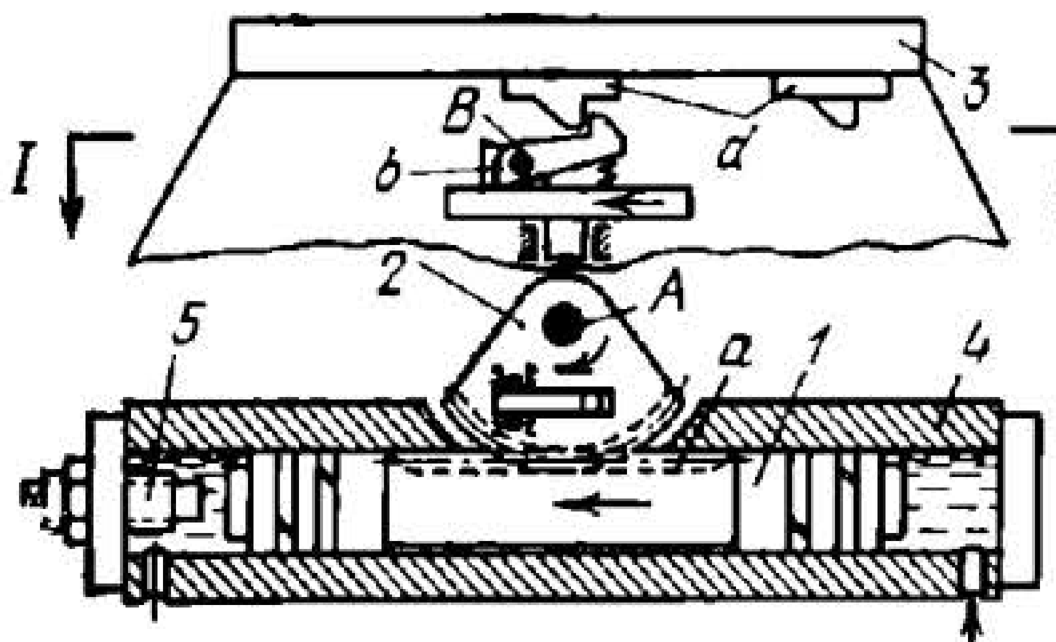
When compressed air is delivered through directional valve *1* to cylinder *2*, piston *3* moves to the left. Gear rack *a* on the piston rotates pinion *4* which meshes with rack *d* of spindle quill *5*, feeding the quill and spindle to the right. Mounted on shaft *O* of pinion *4* are two more pinions, *6* (see lower drawing) and *7*, which rotate together with pinion *4*. Pinion *6* advances sleeve *8* with whose rack it meshes. When sleeve *8* reaches piston *9*, the speed of travel of the spindle quill is considerably reduced due to the resistance of the hydraulic fluid under the piston. Fluid from cylinder *10* is forced out through pressure reducing valve *11* and flow-control valve *12* into the tank. By adjusting the clear opening in valve *12*, the rate of fluid flow out of cylinder *10* can be varied, thereby varying the rate of feed of the spindle. Pressure reducing valve *11* maintains constant pressure before flow-control valve *12*, providing for a constant rate of spindle feed. Rack *13*, meshing with pinion *7*, moves upward upon rotation of pinion *4* and, at the end of the spindle travel, contacts lever *14*, turning about fixed axis *A*. Lever *14* depresses a member of pneumatic directional valve *1*, connecting cylinder *2* to the atmosphere. Then spring *15* moves piston *3* to the right, retracting spindle quill *5*. During quill and spindle withdrawal, sleeve *8* moves upward, first by itself and then, when it reaches nut *16*, together with piston *9*. As piston *9* moves upward, hydraulic fluid is drawn from the tank through ball check valve *17* and into cylinder *10*. Regulating nut *16* sets the length of rapid approach of the spindle and regulating screws *18* and *19* set up the point of tool (spindle) withdrawal.

HYDRAULIC DRIVE MECHANISM OF A TRACING DEVICE



Fluid under pressure is delivered to the right end of cylinder *1* and to valve spool *2*. Piston *3* with template *4* is moved to the left by the fluid. Fluid from the left end of cylinder *1* is discharged through a groove of valve spool *2* to the tank. During template travel, stylus *5*, held against template *4* by spring *6*, raises valve spool *2*, admitting fluid to the lower end of fixed cylinder *7*, which moves piston *8* and sleeve *9*, attached to the piston, upward together with the single-point cutting tool (not shown) until spool *2* blocks off the port of the sleeve. This stops the flow of fluid to cylinder *7*. Fluid from the upper end of cylinder *7* is discharged through the valve to the tank. When stylus *5* is moved downward by spring *6* in following the profile of the template, piston *8* and the cutting tool also move downward. Thus the tool motion follows a curve which traces the profile of the template.

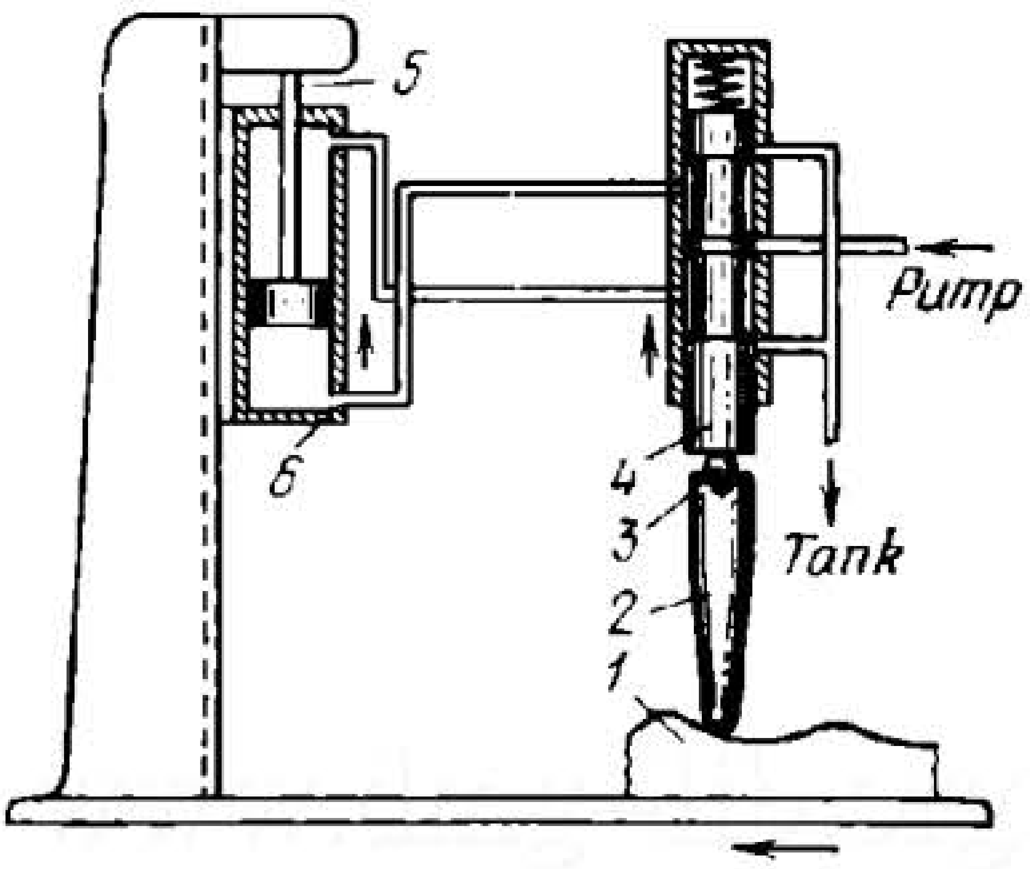
4208.	HYDRAULIC DRIVE MECHANISM OF AN INDEXING TABLE	CHP Dr



Section I-I

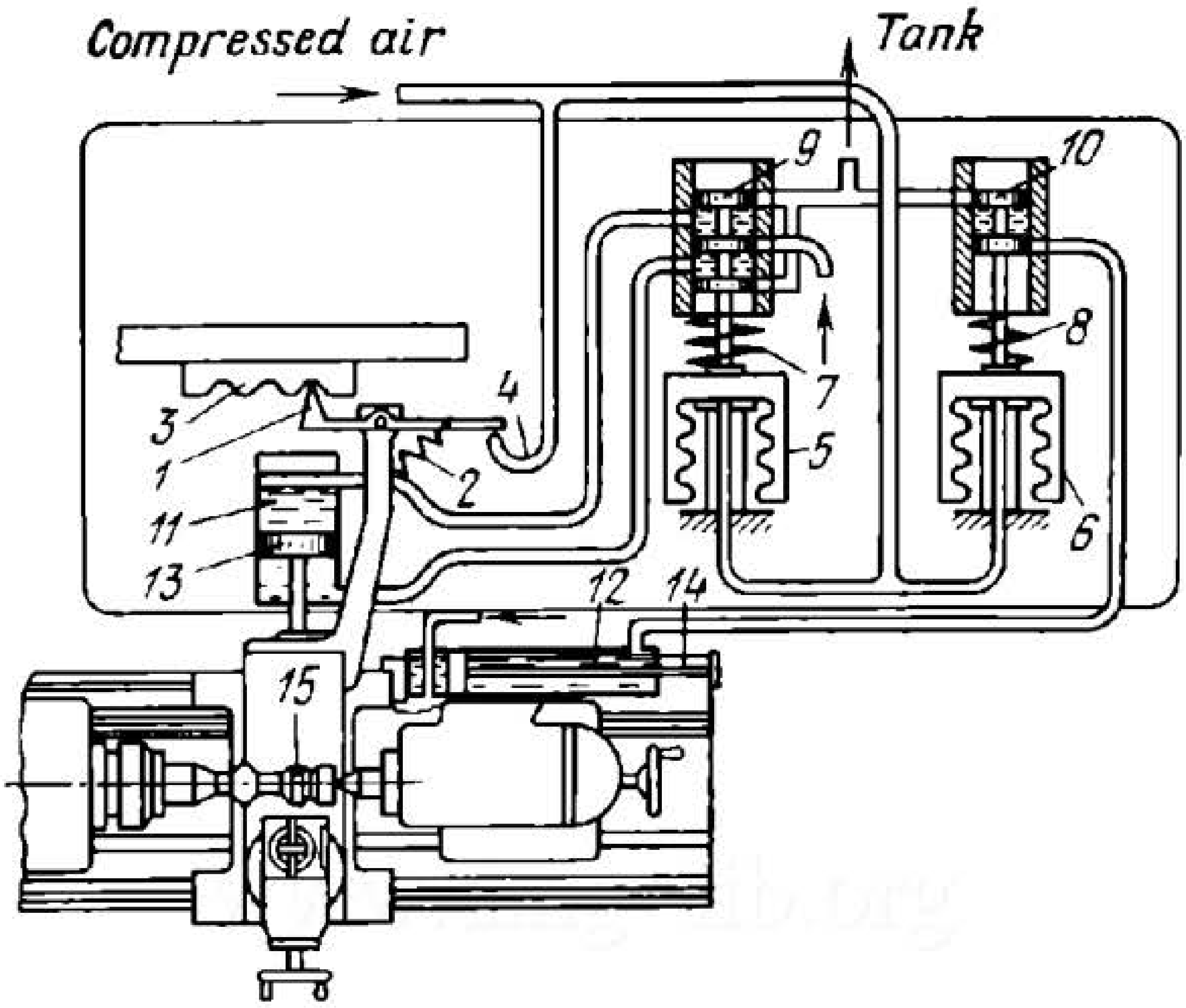
When piston *1* is moved to the left by the action of fluid, rack *a*, meshing with segment gear *2*, turns the gear about fixed axis *A*. Gear *2* turns table *3* by means of stop dogs *d* and pawl *b*, which turns about axis *B*. At the end of the indexing motion, the angular velocity of the table is reduced by reducing the flow of fluid to cylinder *4*. The table is stopped by adjustable stop *5*.

4209	HYDRAULIC DRIVE MECHANISM OF A THREE-DIMENSIONAL TRACING DEVICE	CHP Dr



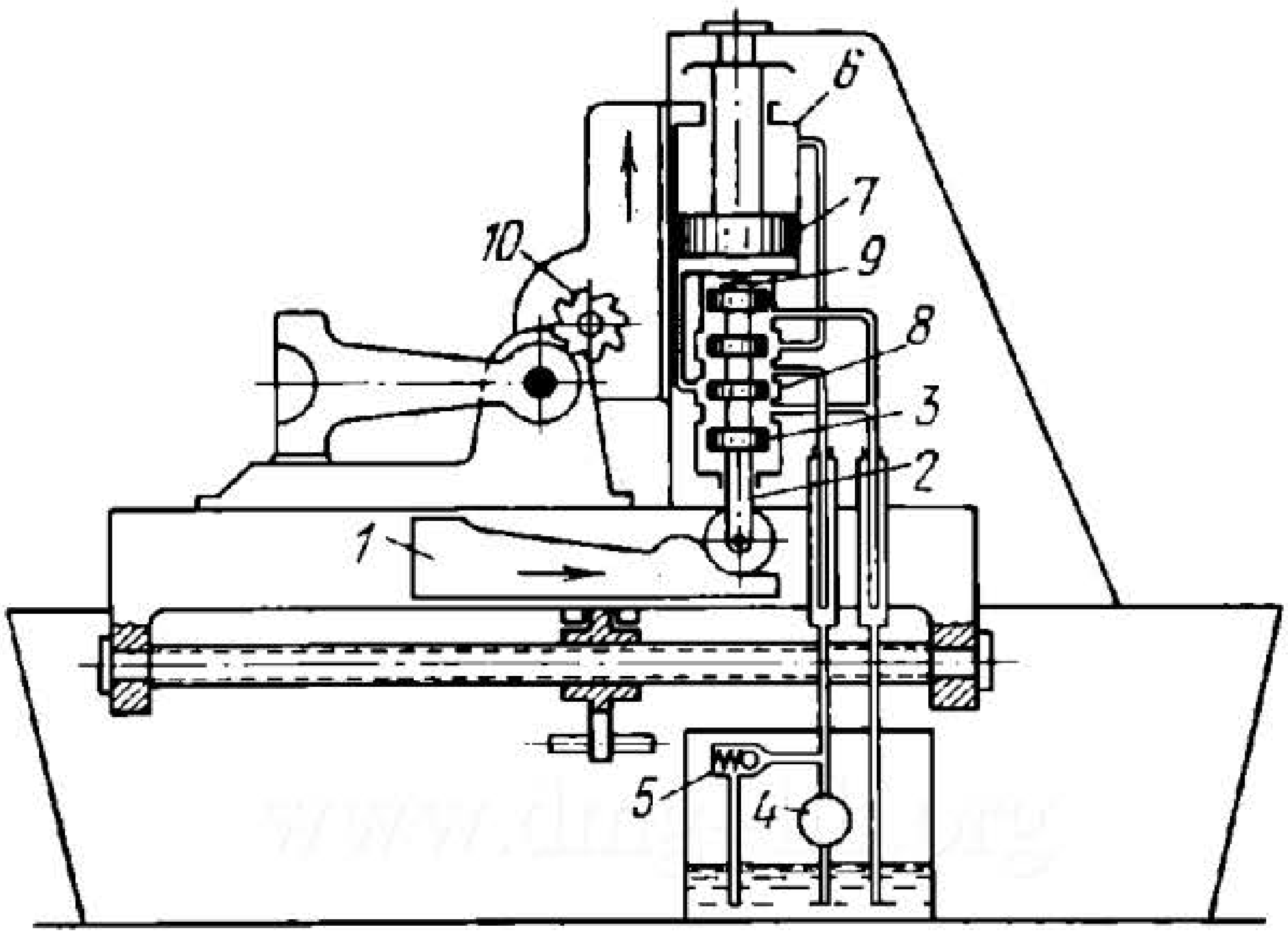
Upon horizontal travel of template *1*, stylus *2*, through steel ball *3*, actuates valve spool *4*. When the stylus is moved upward by the contour of the template, spool *4* moves upward and fluid, delivered by the pump to the valve, is admitted into the upper end of cylinder *6*. Piston rod *5* is fixed and cylinder *6* is attached to the vertical slide of the spindle head. From the lower end of cylinder *6* fluid is discharged through the valve to the tank. At this, the spindle head travels upward. When the stylus moves downward, spool *4* descends below its middle position and fluid from the pump is admitted into the lower end of cylinder *6*. At this, the spindle head travels downward. Fluid from the upper end of cylinder *6* is discharged through the valve to the tank.

HYDROPNEUMATIC DRIVE MECHANISM OF A LATHE TRACING DEVICE



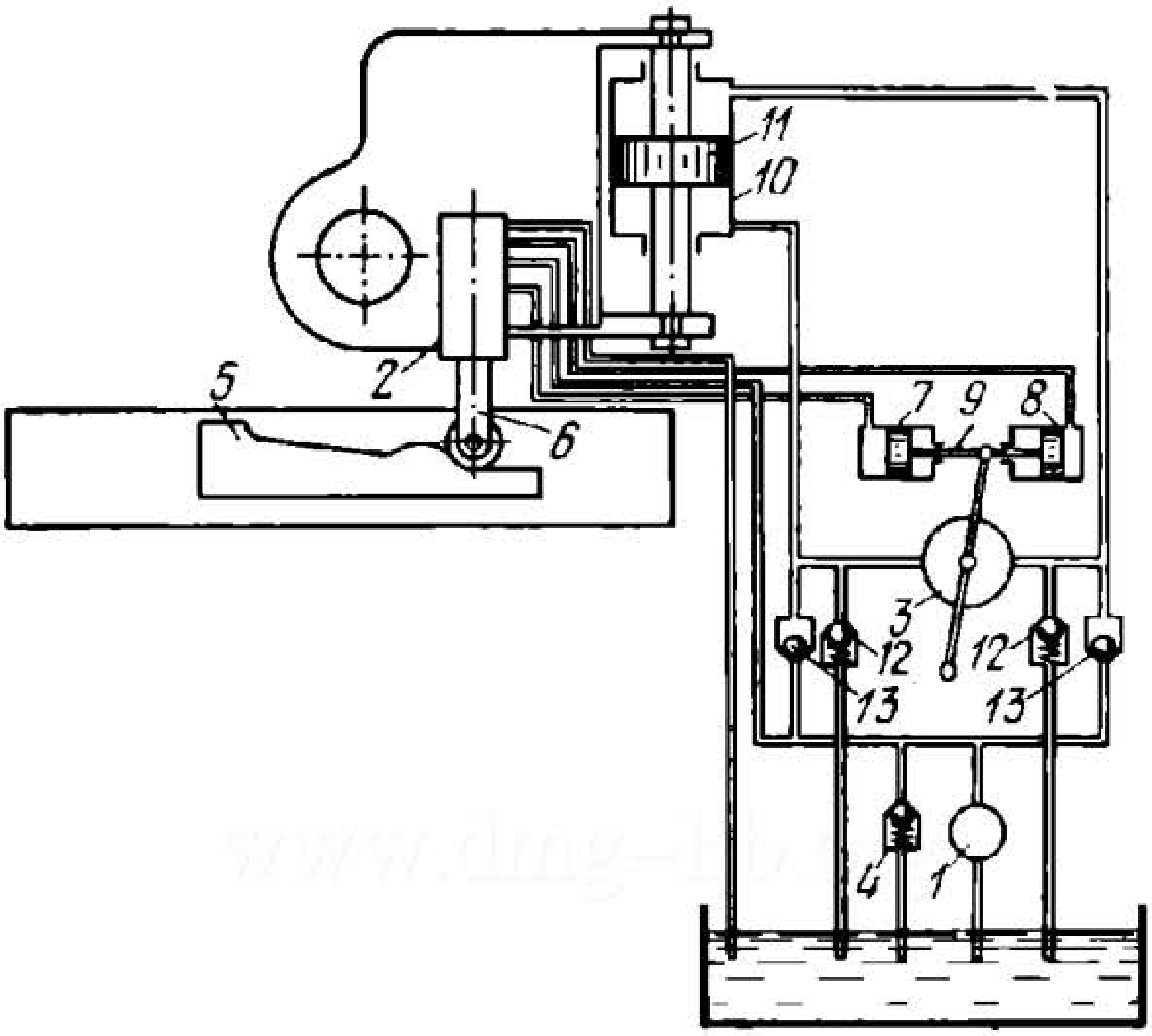
Stylus *1*, mounted on a bracket of the cross slide, is held by spring *2* in contact with the profile of template *3* and travels along the template upon longitudinal travel of the saddle. As it turns back and forth, stylus *1* varies the flow of air from nozzle *4* to which air is delivered under pressure. The variations in air pressure actuate bellows *5* and *6*, counterbalanced by springs *7* and *8*, which shift valve spools *9* and *10*. Valve spool *9* controls the operation of cross feed cylinder *11* by admitting hydraulic fluid into it. The fluid is delivered to the valve by a pump. Cylinder *11* is secured to the lathe bed and the rod of its piston *13* is linked to the cross slide. Valve spool *10* controls the longitudinal feed of the slide by releasing fluid from cylinder *12* to which it is delivered under pressure. Piston rod *14* is linked to the bed, and the cylinder travels together with the saddle. Thus, the single-point tool reproduces a contour on work *15* which corresponds to the profile of template *3*.

4211	HYDRAULIC DRIVE MECHANISM OF A PROFILE MILLING MACHINE	CHP Dr



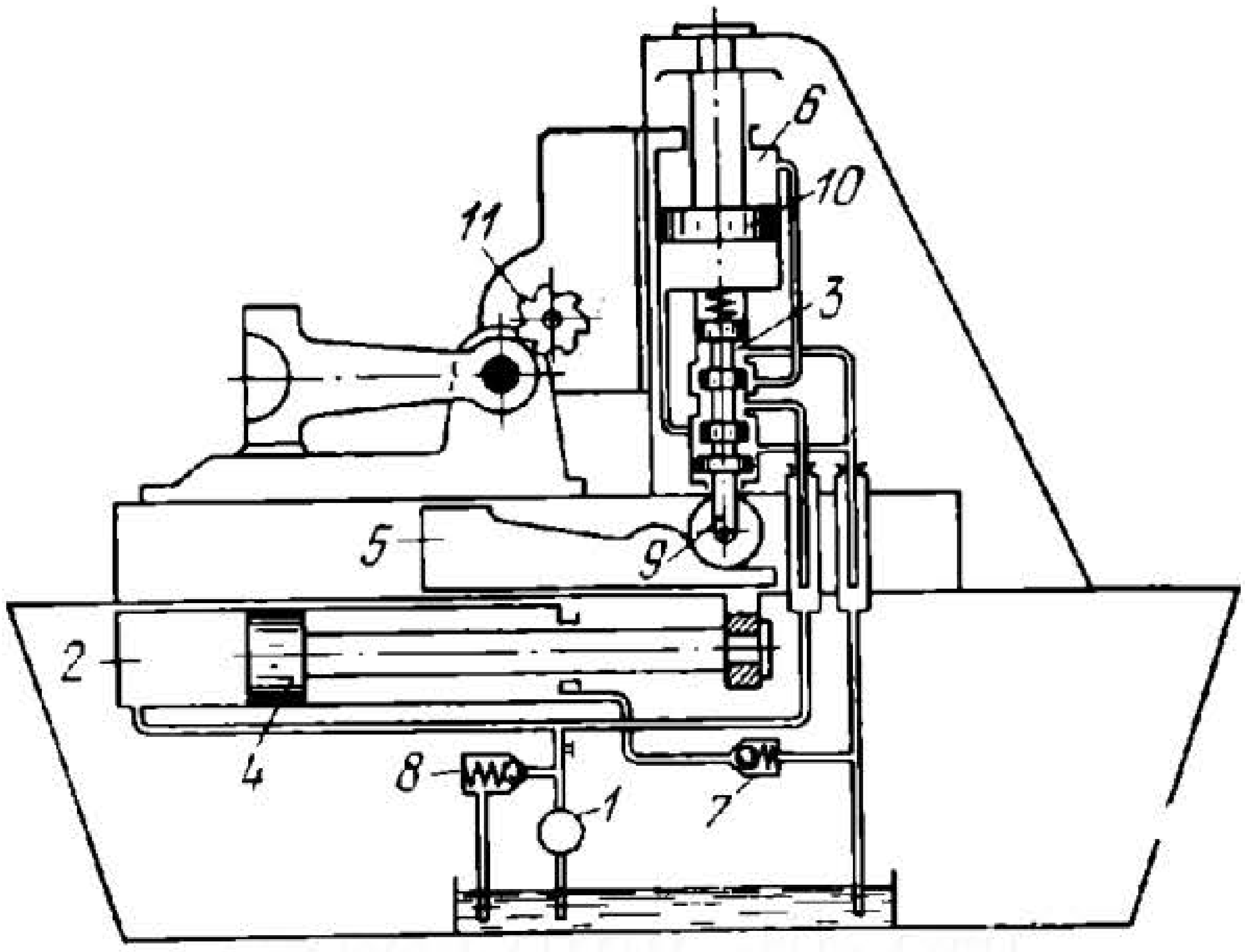
Upon longitudinal travel of template *1* at constant speed, tracer *2*, equipped with a roller, raises valve spool *3*. At this, fluid, delivered under pressure by pump *4* to valve body *8* at a pressure maintained by relief valve *5*, is admitted to the upper end of cylinder *6* whose piston *7* is rigidly attached to an upright of the milling machine. Cylinder *6*, as well as valve body *8* and milling cutter *10*, is mounted on the vertical slide, and they travel upward until spool *3* blocks off ports in valve body *8*, stopping fluid delivery to the upper end of cylinder *6*. Fluid from the exhaust end of cylinder *6* is discharged through valve *8* to the tank. When tracer *2*, held in contact with template *1* by spring *9*, moves downward, a similar process is repeated, but only in the opposite direction. Thus, milling cutter *10* machines a surface on the work corresponding to the profile of template *1*.

4212	HYDRAULIC DRIVE MECHANISM OF A TRACER-CONTROLLED MACHINE TOOL	CHP Dr

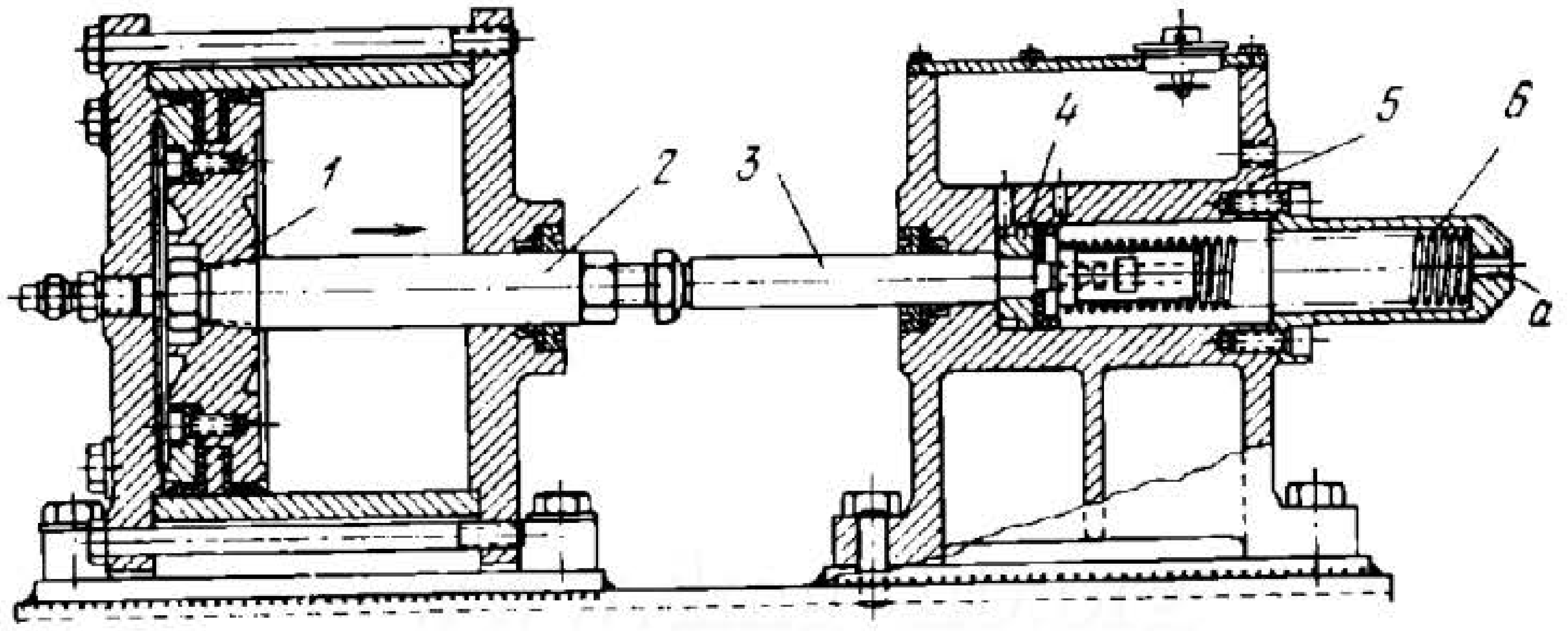


Gear pump *1* delivers fluid to valve *2* and to variable-displacement pump *3* at a pressure maintained by relief valve *4*. Upon longitudinal travel of template *5*, tracer *6*, equipped with a roller and rigidly attached to the spool of valve *2*, moves the spool so that fluid is admitted into one of the servomotor cylinders, *7* or *8*. Rod *9*, shifted to the right or left by the action of the fluid, changes the eccentricity of variable-displacement pump *3* and, consequently, the amount and direction of the fluid delivered to cylinder *10*. Piston *11*, secured to the vertical slide of the machine tool together with the body of valve *2* and the cutting tool, travels up or down until the spool of valve *2* blocks off a port in the valve body and stops fluid delivery to the servomotor cylinder. Thus, the cutting tool machines a surface on the work corresponding to the profile of template *5*. Relief valves *12* protect the system against overloads. Check valves *13* serve to supply fluid to variable-displacement pump *3*.

4213	HYDRAULIC DRIVE MECHANISM OF A PROFILE MILLING MACHINE	CHP Dr



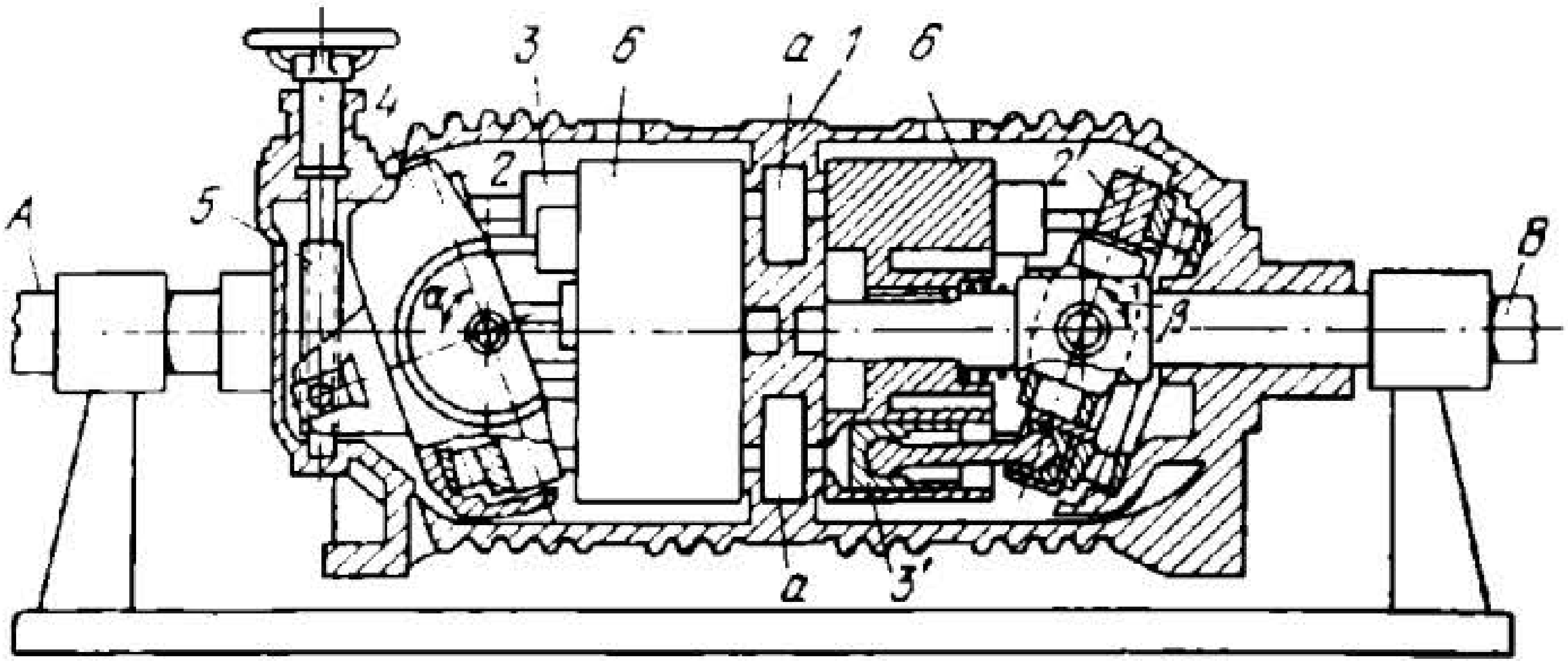
Pump *1* delivers fluid to the left end of cylinder *2* and to the body of valve *3*. Piston *4* and template *5*, which is rigidly attached to the piston rod, are moved to the right by the fluid. Fluid from the right end of cylinder *2* is discharged through check valve *7* to the tank. Relief valve *8* maintains a definite pressure in the system. Upon travel of template *5*, tracer *9*, equipped with a roller and rigidly attached to the spool of valve *3*, raises the spool. At this, fluid from pump *1* is delivered to the upper end of cylinder *6* which is mounted, together with the body of valve *3* and milling cutter *11*, on the vertical slide of the milling machine. The rod of piston *10* is attached to the column. The fluid raises cylinder *6* until the spool of valve *3* blocks off ports in the valve body, stopping fluid delivery to cylinder *6*. Fluid from the exhaust end of the cylinder is discharged through valve *3* to the tank. When tracer *9* moves downward, cylinder *6* also moves downward together with the milling cutter. Thus, milling cutter *11* reproduces a contour on the work which corresponds to the profile of template *5*.



As piston *1* is moved to the right by the action of compressed air, rod *2* of the piston, actuates rod *3* of the hydraulic booster, moving piston *4* to the right. As piston *4* moves in cylinder *5*, compressing the hydraulic fluid in the cylinder, it develops the required pressure in the hydraulic circuit connected to port *a*.

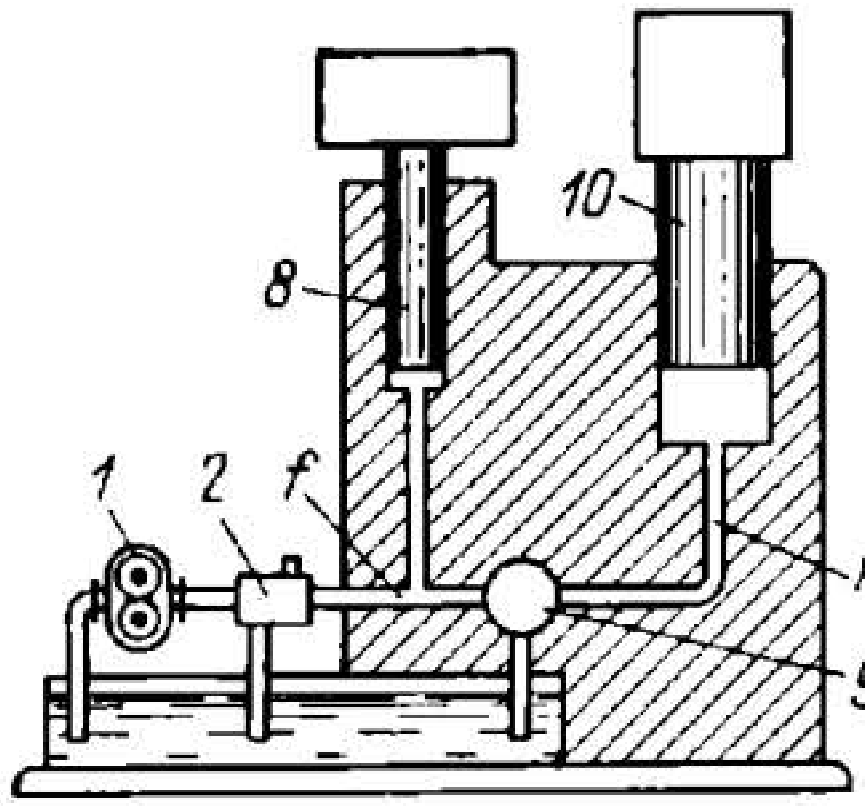
Spring *6* returns pistons *4* and *1* to the initial position.

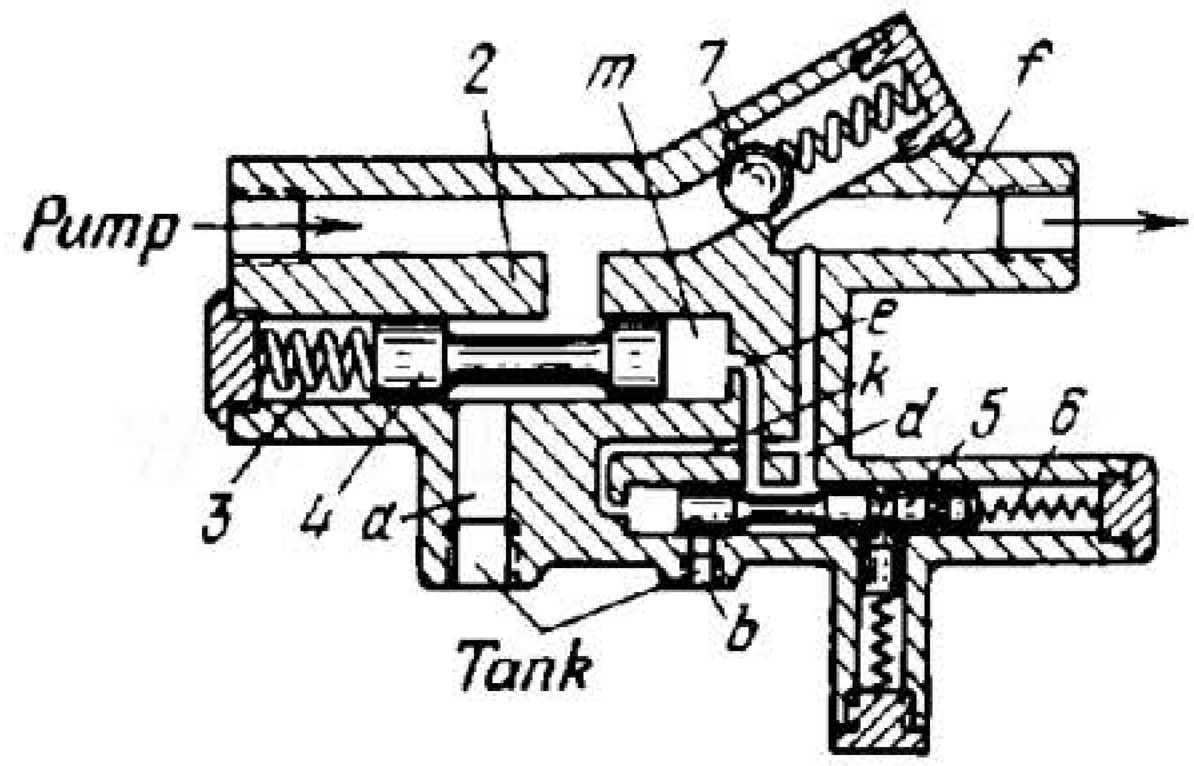
4215	HYDRAULIC DRIVE MECHANISM WITH SWASH PLATES	CHP Dr



The hydraulic drive consists of a combination of a hydraulic pump and a hydraulic motor of identical design in which a Hooke's joint is used. Upon rotation of driving shaft A, swash plate *2* reciprocates pistons *3* which draw in fluid and deliver it into chamber a of fixed distribution member *1*, from where it is admitted into the cylinders of the hydraulic motor. The fluid reciprocates pistons *3'* which are linked to swash plate *2'*, fixed at the angle β to driven shaft B. Swash plate *2* can be tilted to various angles α to the driving shaft with cup member *4* in which it rotates. This tilting motion is accomplished by handwheel and screw device *5*. The cylinders of pistons *3* and *3'* are in cylinder blocks *6* and *6'*, keyed to the driving and driven shafts. When $\alpha = \beta$, the speeds of the driving and driven shafts are equal. If cup member *4* is inclined in the other direction, the rotation of driven shaft B is reversed.

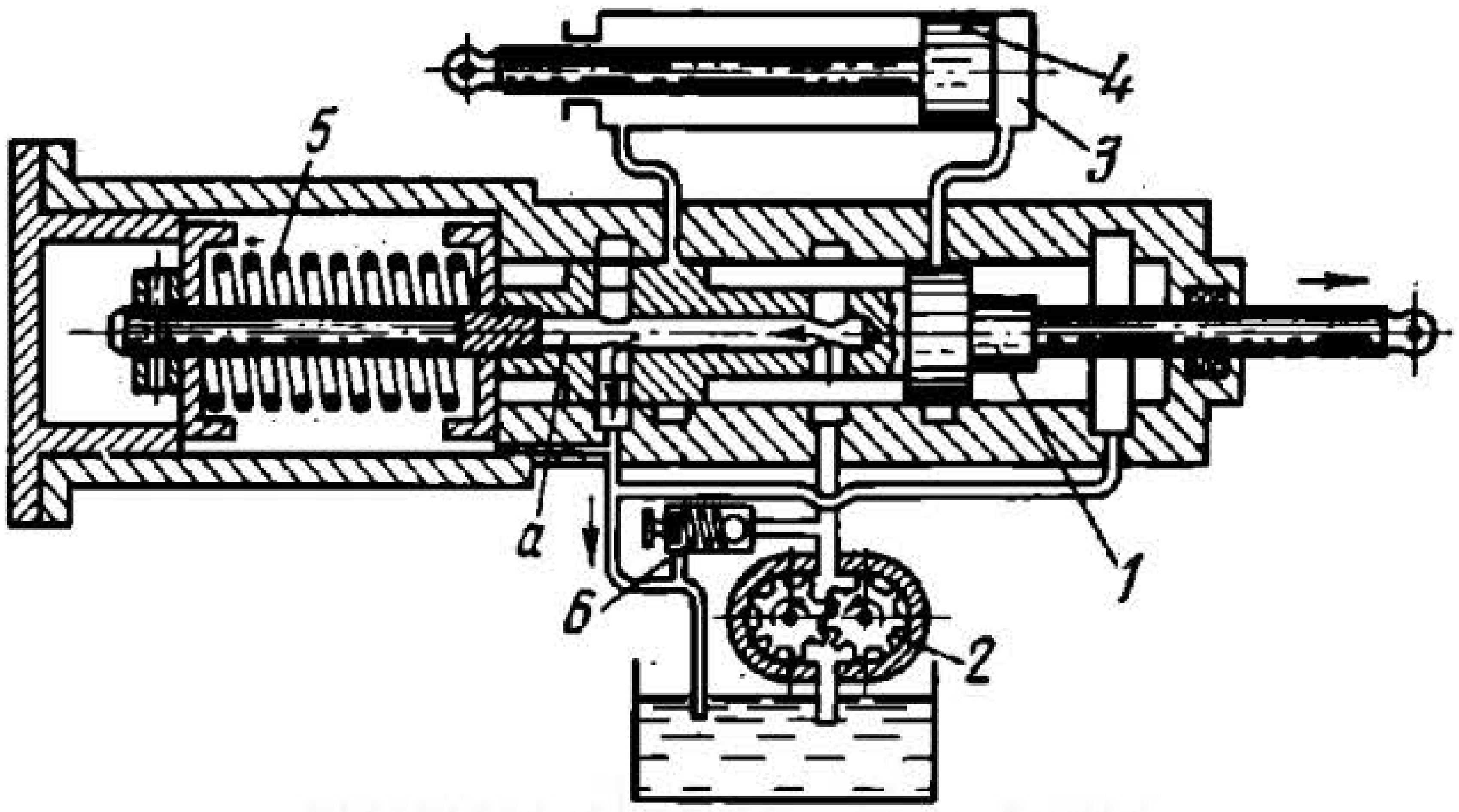
4216	HYDRAULIC DRIVE MECHANISM WITH AN ACCUMULATOR	CHP Dr





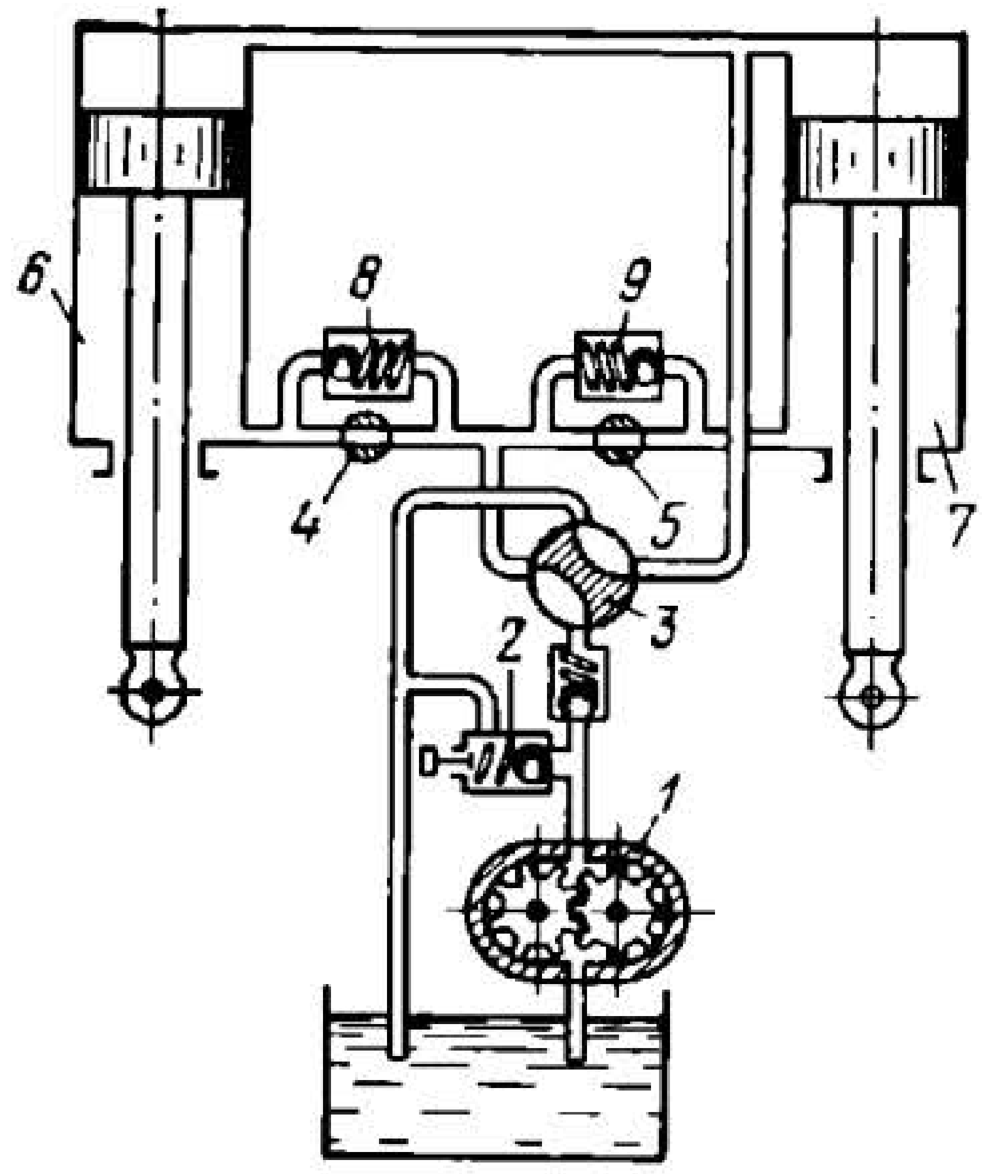
Fluid is delivered under pressure by pump *1* to valve *2*. Actuated by spring *3*, spool *4* closes port *a*, and spring *6* actuates spool *5* to close passage *d* and open port *b*. The fluid forces back ball *7* and flows through pipeline *f* to accumulator *8*. At this, rotary valve *9* is closed. Pressure increases in the system. Then fluid passing along passage *k* acts on spool *5*, shifting it to open passage *d* and close port *b*. The fluid then passes through passage *e* into chamber *m*, shifting spool *4* to the position shown. This opens port *a* and fluid delivered by pump *1* is discharged to the tank. By turning valve *9*, pipelines *n* and *f* are connected together and fluid from accumulator *8* is delivered to hydraulic actuator *10*, whose plunger rises to the required height. By turning valve *9* to its third position pipelines *n* and *f* are connected to the tank, the plunger of actuator *10* descends and the fluid is discharged through pipeline *n* to the tank. This reduces the pressure in the left-hand part of the system. Spool *5* is shifted to the left by spring *6*, closing passage *d* and opening port *b*. Fluid from chamber *m* is discharged by spool *4* to the tank. At this, port *a* is closed and all the fluid delivered by pump *1* is admitted again into accumulator *8*.

4217	HYDRAULIC DRIVE MECHANISM WITH A SPRING-RETURNED VALVE SPOOL	CHP Dr



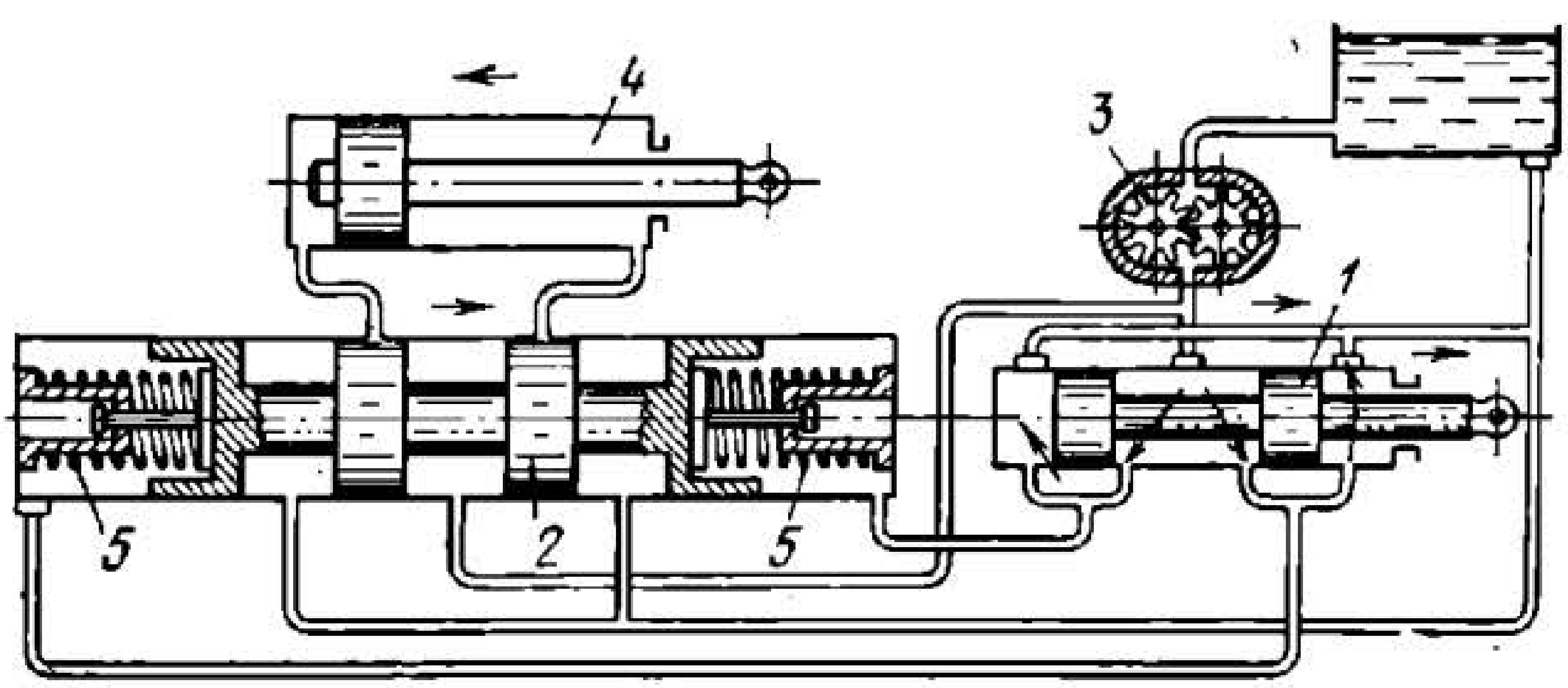
When valve spool *1* is shifted manually to the right, fluid is delivered by gear pump *2* to the right end of power cylinder *3*, moving piston *4* to the left. Fluid from the left end of cylinder *3* is discharged through the valve body to the tank. If the stem of spool *1* is not held by force, then spring *5*, compressed when the spool is shifted to the right, returns the spool to its neutral position (as shown). At this, pump *2* is connected to the tank through axial passage *a* in spool *1*, and the fluid is blocked off inside cylinder *3*. Spring *5* returns spool *1* in a similar way from its extreme left-hand position. Relief valve *6* protects the system against overloads.

4218	HYDRAULIC DRIVE MECHANISM WITH SYNCHRONIZED MOTION OF TWO PISTONS	CHP Dr



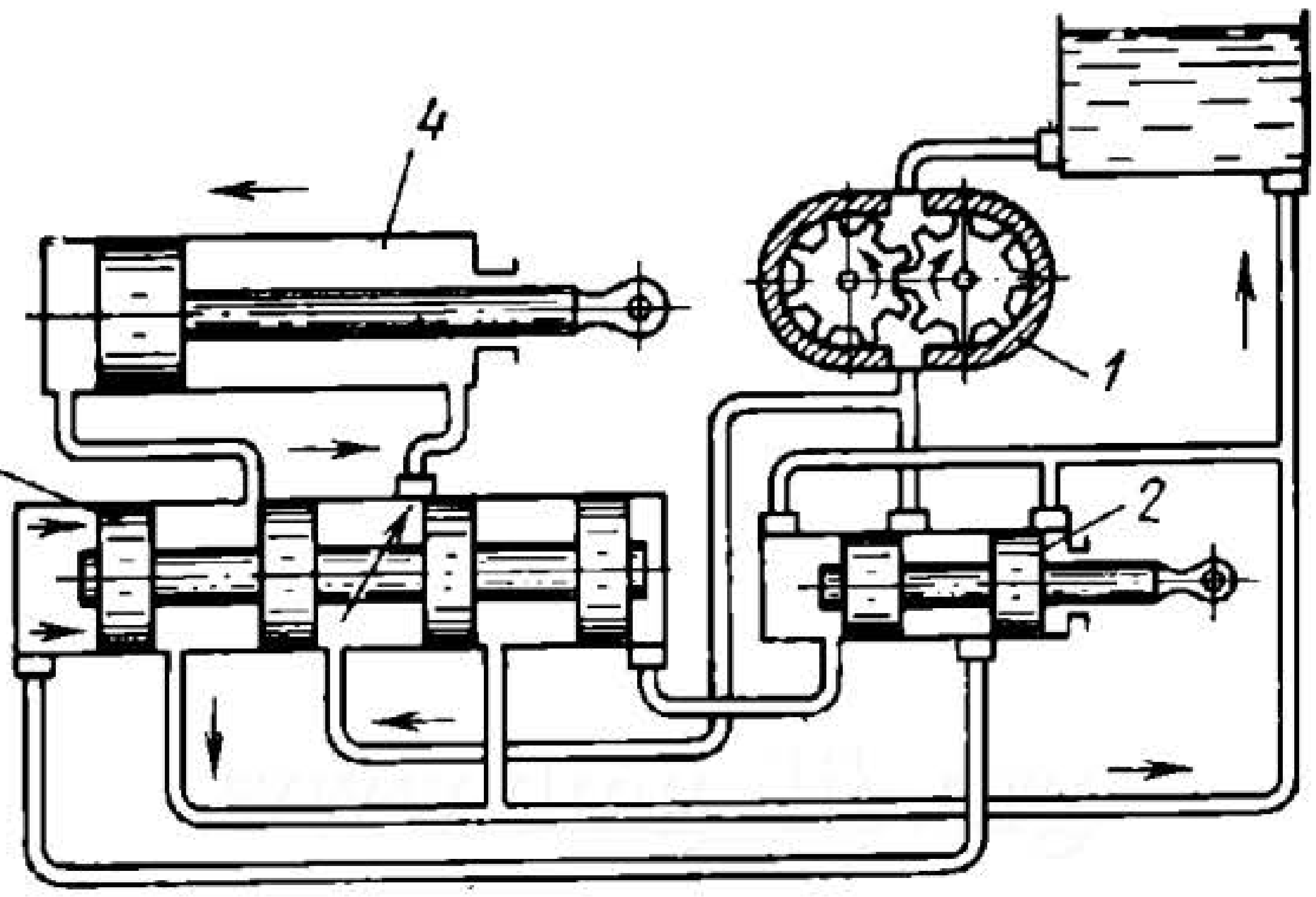
Gear pump *1* delivers fluid under a pressure established by relief valve *2* through rotary directional valve *3* and flow-control valves *4* and *5* to power cylinders *6* and *7*. Fluid from the exhaust end of the cylinders is discharged through valve *3* to the tank. Flow-control valves *4* and *5* can be regulated to admit equal amounts of fluid to cylinders *6* and *7*. Check valves *8* and *9*, enabling the fluid to by-pass the flow-control valves, provide for rapid return strokes when valve *3* is switched over.

4219	HYDRAULIC DRIVE MECHANISM WITH A MECHANICALLY OPERATED PILOT VALVE	CHP Dr



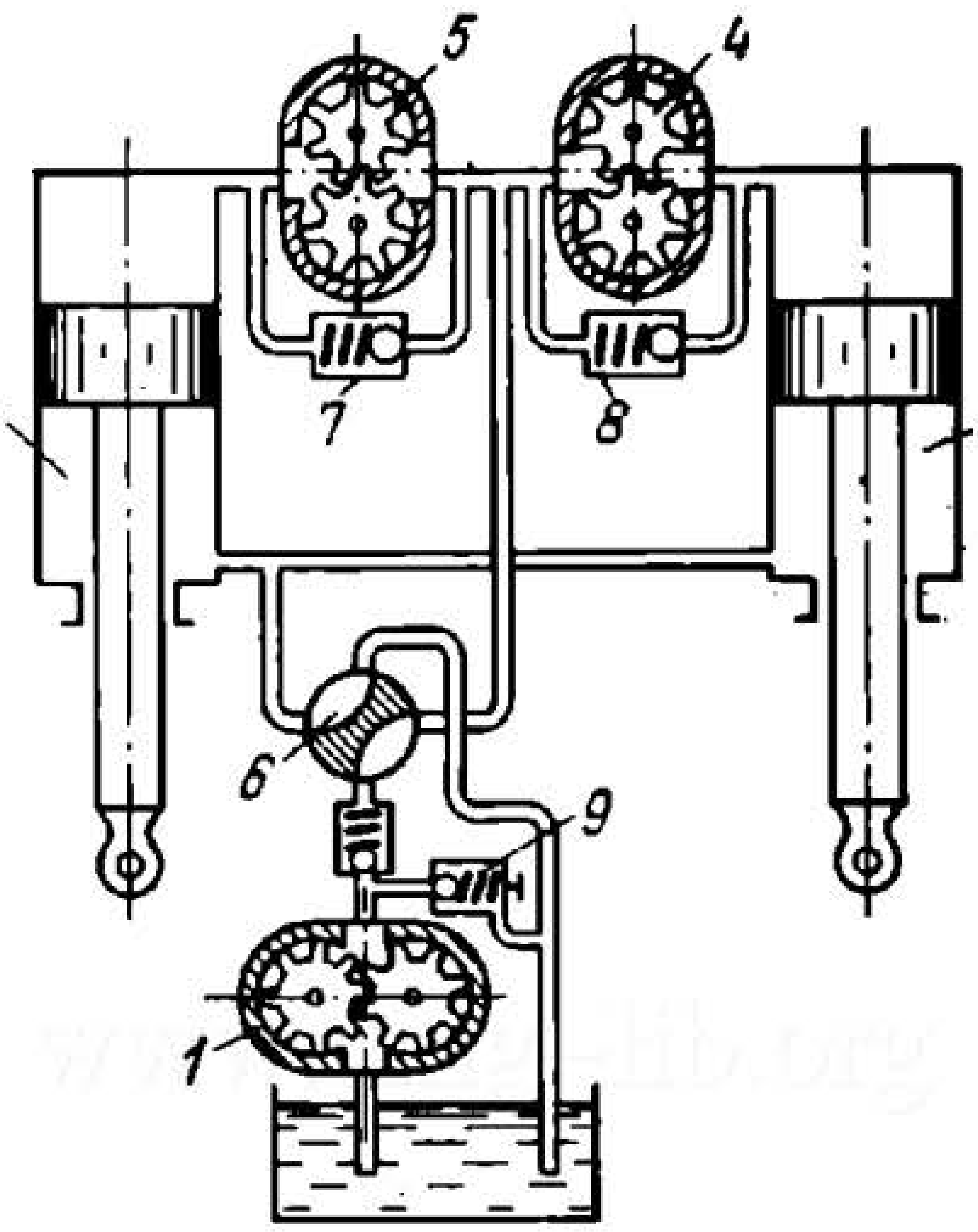
When pilot valve spool *1* is shifted to the right, fluid is delivered from the valve to the left end of main valve spool *2*, shifting it also to the right. At this, fluid is delivered by gear pump *3* through a groove of spool *2* to the right end of power cylinder *4*, moving its piston to the left. When pilot valve spool *1* is shifted to the left, spool *2* is also shifted by pilot fluid to the left, admitting fluid delivered by pump *3* to the left end of cylinder *4*. In the central position of spool *1*, main valve spool *2* is centered by springs *5*.

4220	REMOTE-CONTROLLED HYDRAULIC DRIVE MECHANISM WITH A MECHANICALLY OPERATED PILOT VALVE	CHP Dr



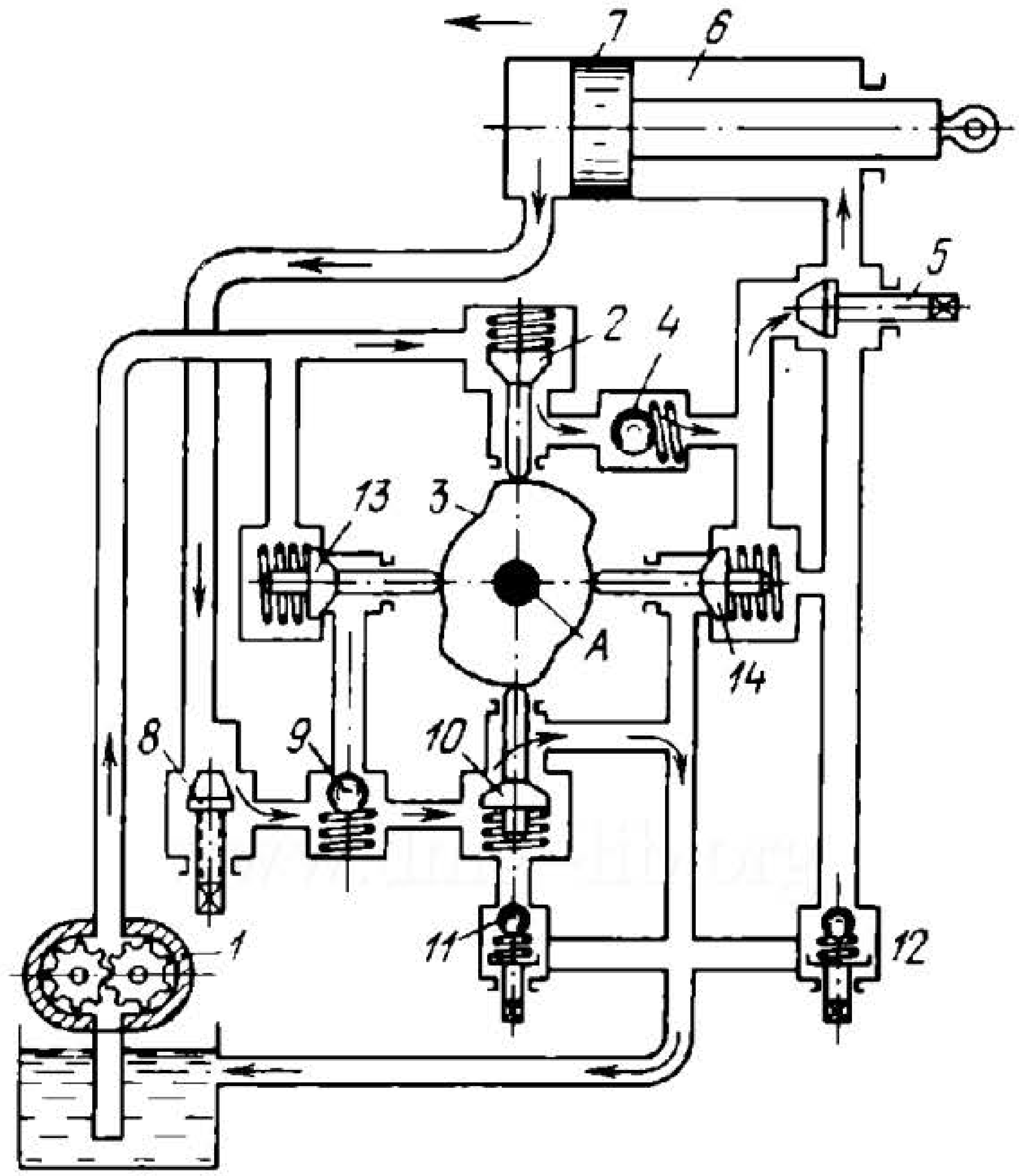
In the position of pilot valve spool *2* shown, fluid from gear pump *1* is delivered partly through the body of the pilot valve to the left end of main valve spool *3*, shifting the spool to the right. The main part of the fluid delivered by pump *1* is directed by a groove of spool *3* to the right end of power cylinder *4*, moving its piston to the left. When pilot valve spool *2* is shifted to the left, spool *3* is also shifted by pilot fluid to the left, and fluid from pump *1* is delivered to the left end of cylinder *4*. Thus, pilot valve spool *2* serves to control spool *3* of the pilot-operated main valve.

4221	HYDRAULIC DRIVE MECHANISM WITH SYNCHRONIZED MOTION OF TWO PISTONS	CHP Dr



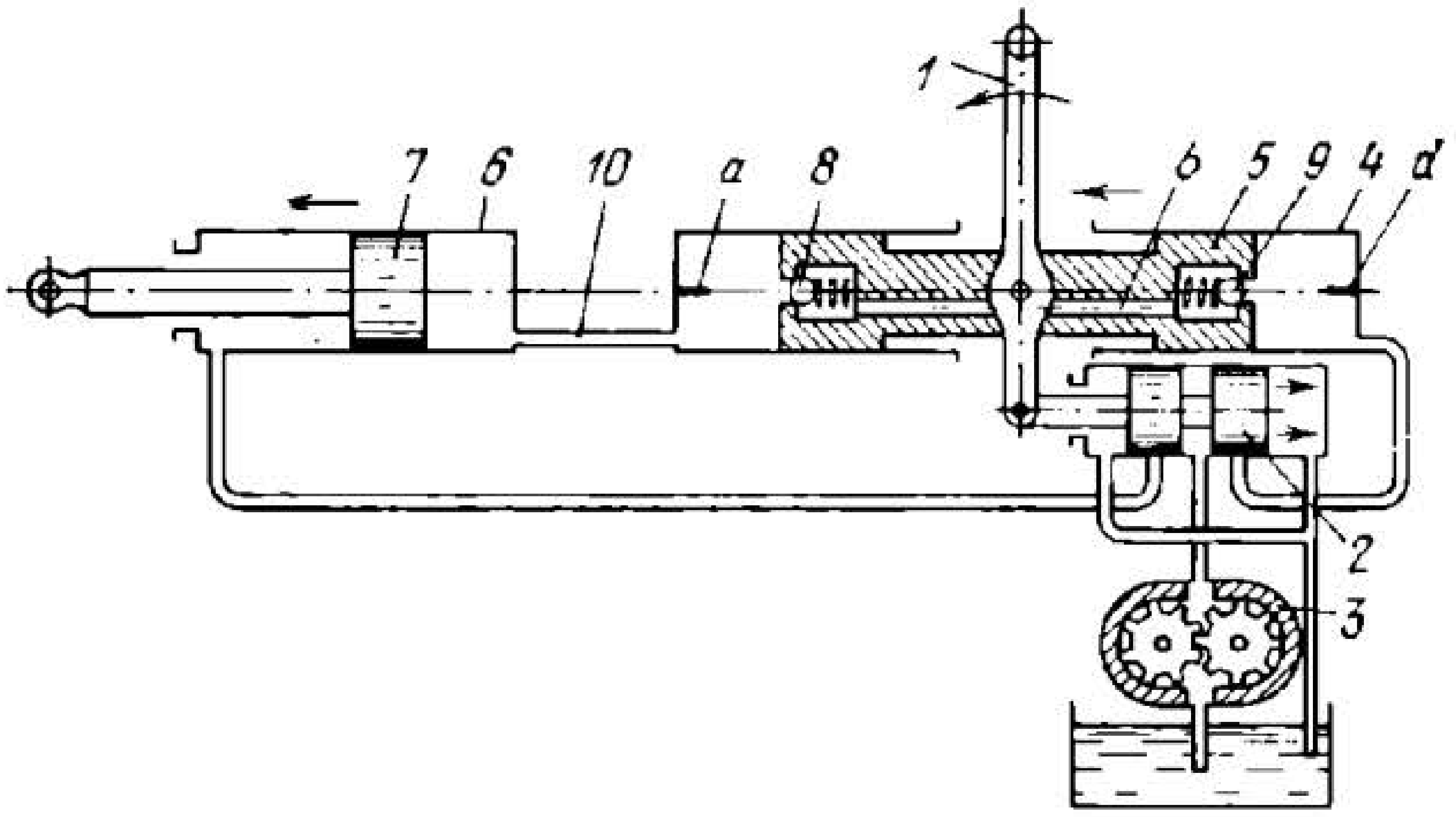
Gear pump *1* delivers fluid to power cylinders *2* and *3* through rotary directional valve *6* and gear pumps *5* and *4* with their gears keyed to the same shafts. Gear pumps *4* and *5* operate as hydraulic motors. If motors *4* and *5* are of the same size, equal amounts of fluid are delivered to cylinders *2* and *3* in each revolution of the motors. If a higher resisting force (load) is applied to the piston rod of one of the cylinders than to the other, the hydraulic motor on the side of the overloaded cylinder will operate as an intermediate pump, raising the pressure of the fluid delivered by pump *1* to that required to overcome the resistance of the overloaded cylinder. The second motor will operate as a drive for the first motor. Relief valves *7* and *8* are adjusted to a pressure exceeding the maximum pressure required to accomplish the working operations and less than the pressure setting of relief valve *9*.

4222	HYDRAULIC DRIVE MECHANISM WITH CAM-OPERATED POPPET VALVES	CHP Dr



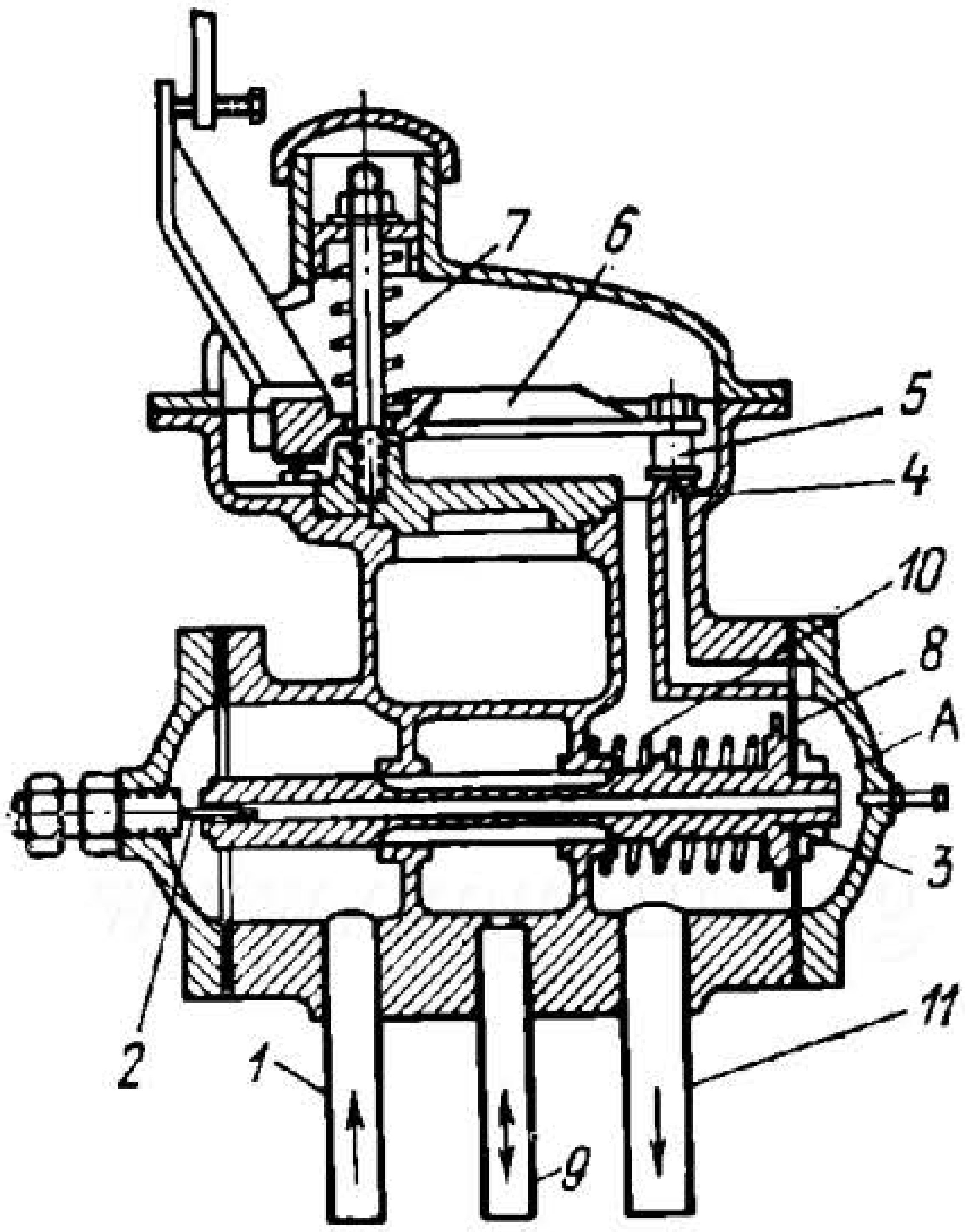
Cam *3* rotates about fixed axis A. In the position of cam *3* shown, gear pump *1* delivers fluid through open inlet valve *2* and further, through check valve *4*, preventing reverse flow of the fluid, and flow-control valve *5* to the right end of power cylinder *6*, moving piston *7* to the left. From the left end of cylinder *6* fluid is discharged through flow-control valve *8*, check valve *9* and outlet valve *10* to the tank. Relief valves *11* and *12* maintain constant pressure at the flow-control valves which regulate the speed of piston *7*. At the position of cam *3* perpendicular to that shown, fluid is delivered by the pump to the left end of cylinder *6*, two opposite valves, *13* and *14*, being opened by the cam.

4223	HYDRAULIC DRIVE MECHANISM WITH SYNCHRONIZED MOTION OF TWO PISTONS	CHP Dr



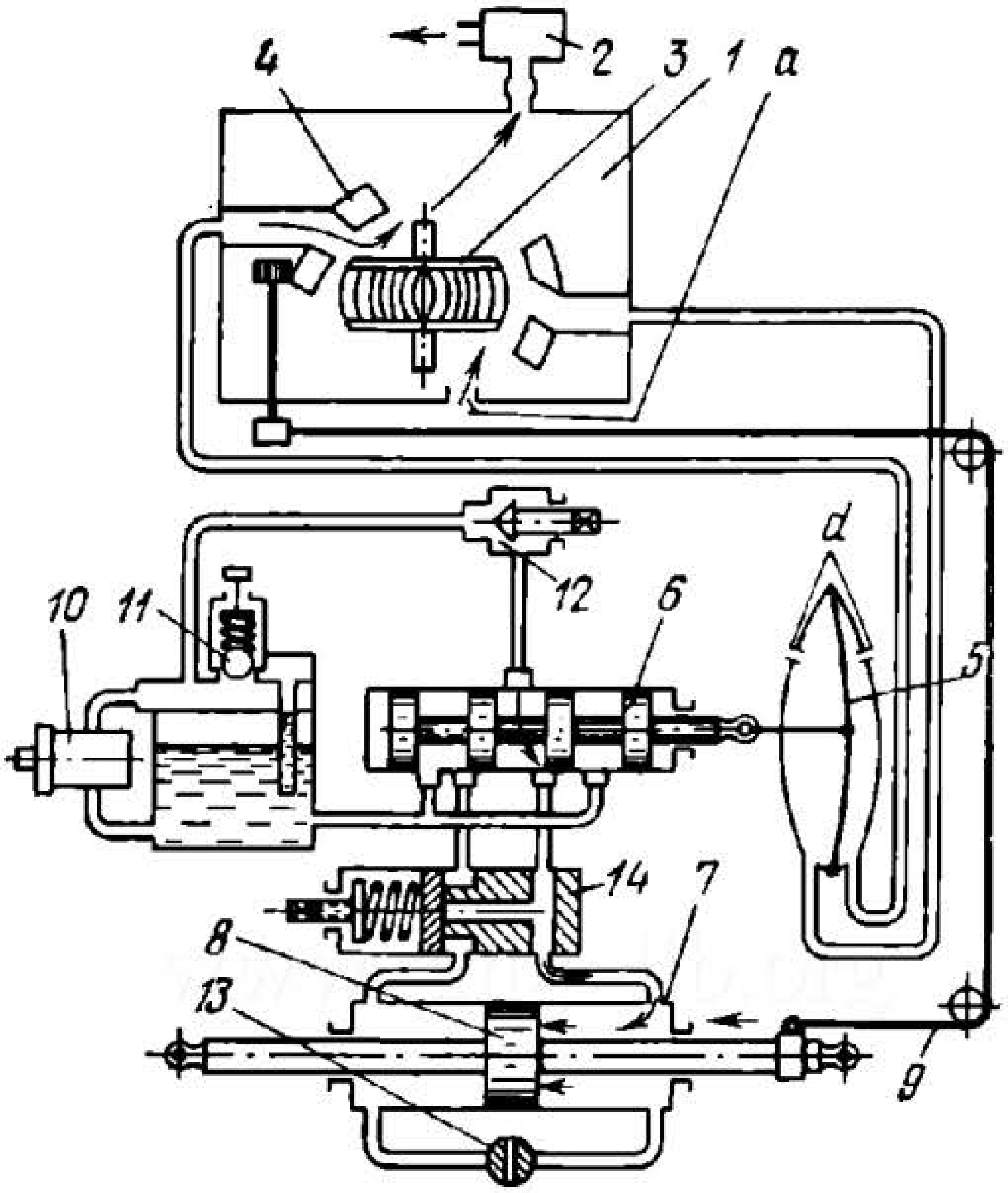
When lever *1* is turned counterclockwise, valve spool *2* is shifted to the right. Then fluid is delivered by gear pump *3* through the groove of valve spool *2* to the right end of cylinder *4*, moving piston *5* to the left. Fluid from the left end of cylinder *4* is admitted through pipeline *10* to the right end of cylinder *6*, moving piston *7* also to the left. Fluid from the left end of cylinder *6* is discharged through the valve body of spool *2* to the tank. Pistons *5* and *7* continue travel as long as lever *1* turns. The axle of lever *1* is mounted in piston *5*. If lever *1* is stopped, it begins to move to the left with piston *5*, shifting spool *2* and disconnecting the delivery line of the pump from the right end of cylinder *4*. When lever *1* is turned clockwise, spool *2* is shifted to the left and fluid from the pump is directed to the left end of cylinder *6*, moving piston *7* to the right. Fluid discharged from the right end of cylinder *6* is delivered through pipeline *10* to the left end of cylinder *4*, moving piston *5* to the right. Again, if lever *1* is stopped from turning, piston *5* shifts spool *2* to the right, blocking off fluid delivery to the left end of cylinder *6*. Valves *8* and *9* are used to compensate for thermal expansion and leakage of the fluid. If, for example, piston *5* reaches its extreme left-hand position before piston *7* reaches its extreme left-hand position, lug *a* opens ball valve *8*. Then fluid from the right end of cylinder *4* opens valve *9*, passes through axial channel *b* and open valve *8* to the left end of cylinder *4* and then to the right end of cylinder *6*, moving piston *7* to its extreme left-hand position. If piston *5* reaches its extreme right-hand position before piston *7* reaches its extreme right-hand position, lug *d* opens valve *9*. Then surplus fluid from the right end of cylinder *6* is discharged through channel *b* to the tank. This enables piston *7* to reach its extreme right-hand position.

4224	LEVER MECHANISM OF A HYDRAULIC INTENSIFIER	CHP Dr



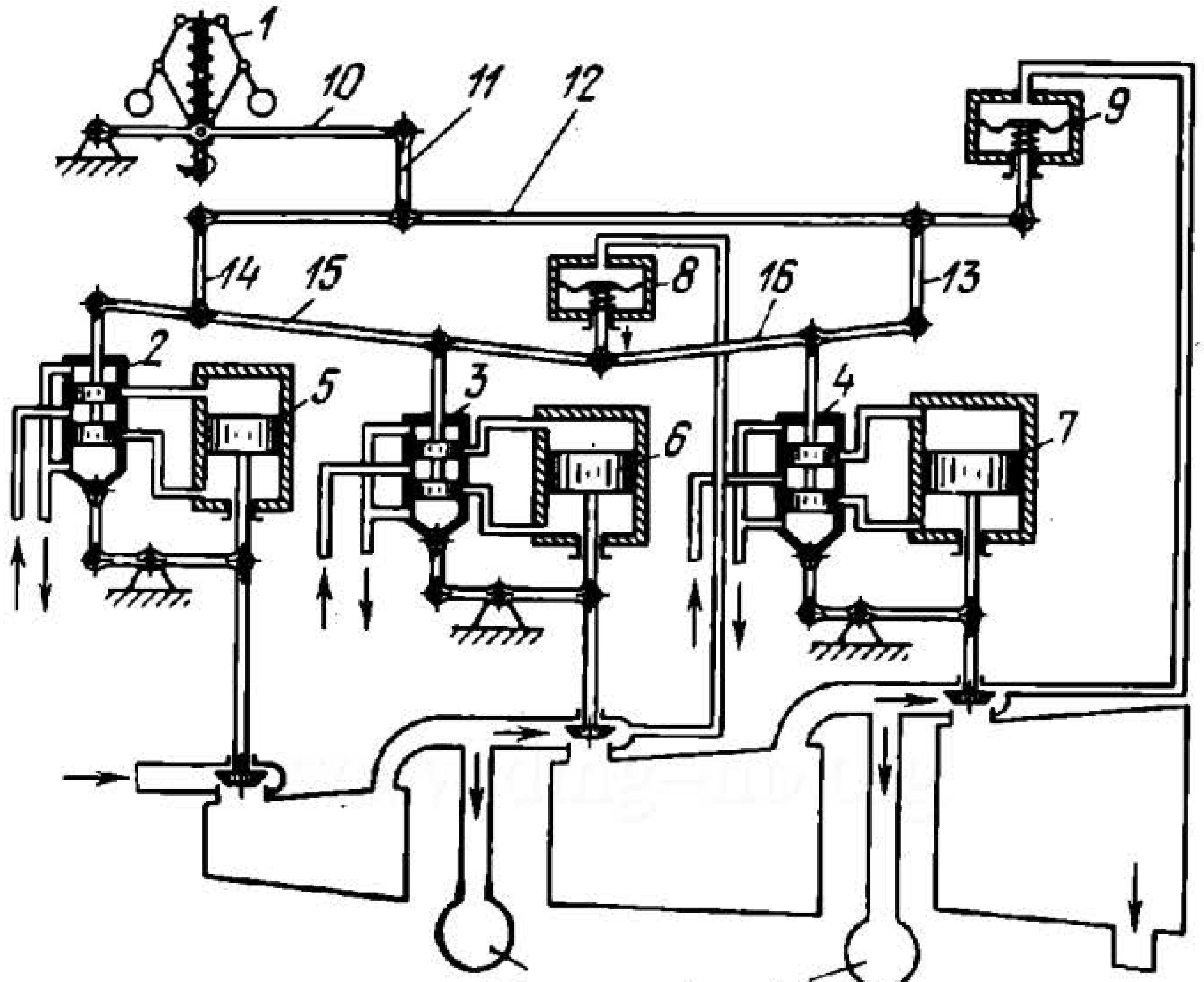
Fluid under pressure, delivered along pipe *1*, passes through throttle *2*, located in the axial passage of valve spool *3*, and is admitted into chamber *A* from where it passes to adjustable nozzle *4*. The nozzle opening is covered by shutter *5*, mounted on bell-crank lever *6*. Lever *6* turns on a knife-edge support and is subject to the action of spring *7*. Acting on the other arm of lever *6* is the operating member of a sensing element which deflects lever *6* upon a change in the parameter being regulated. When shutter *5* approaches nozzle *4*, the pressure is raised in chamber *A* and membrane *8* shifts valve spool *3* to the left. At this, fluid under pressure is delivered through pipe *9* to the hydraulic system. When the pressure in chamber *A* drops, spring *10* shifts spool *3* to the right, connecting pipe *9* of the hydraulic system through pipe *11* to the tank.

4225	AIRCRAFT AUTOPILOT MECHANISM	CHP Rg



The space inside housing 1 of the gyroscope unit, mounted on the airplane, is evacuated, the vacuum being produced by vacuum pump 2. The stream of air admitted through port *a* drives the rotor of gyroscope 3, which has a vertical axis. Rigidly attached to the gyroscope is a shutter (not shown) approaching either of two nozzles 4 to which air is delivered that is drawn in through capillary inlets *d* on the two sides of membrane 5 of the pneumatic relay. Owing to the great difference in the cross sections of the capillary inlets and the nozzles, the same vacuum is produced on the two sides of membrane 5, which is, in this case, in its central position. When the airplane deviates from horizontal flight, the vacuum in the right-hand compartment of the membrane chamber increases and the left-hand compartment is connected to the atmosphere. Membrane 5 is bent to the right, shifting valve spool 6, which admits hydraulic fluid from pump 10 to the right end of power cylinder 7. The fluid moves piston 8 to the left, moving the elevator as required. Fluid from the left end of cylinder 7 is discharged through the valve of spool 6 to the tank. As piston 8 travels, it pulls cable 9, attached at one end to its rod and at the other to nozzles 4. This turns the nozzles with respect to housing 1 so that the left nozzle moves downward and the right nozzle upward. Piston 8 continues to travel until both nozzles are covered to an equal degree by the shutter of the gyroscope. Since the elevator is still inclined downward, the nose of the plane drops and housing 1 turns. At this, the left nozzle is covered and the right nozzle is opened. Piston 8 moves to the right, returning the elevator to its middle position. Then the feedback cable turns the nozzles again so that they are covered equally by the gyroscope shutter. If the airplane flies horizontally, the fluid delivered by pump 10 is discharged through valve 11 to the tank. The speed of travel of piston 8 can be regulated by setting flow-control valve 12. The autopilot is switched off with valve 13. Excess pressure is prevented by relief valve 14 which by-passes fluid from one end of cylinder 7 to the other.

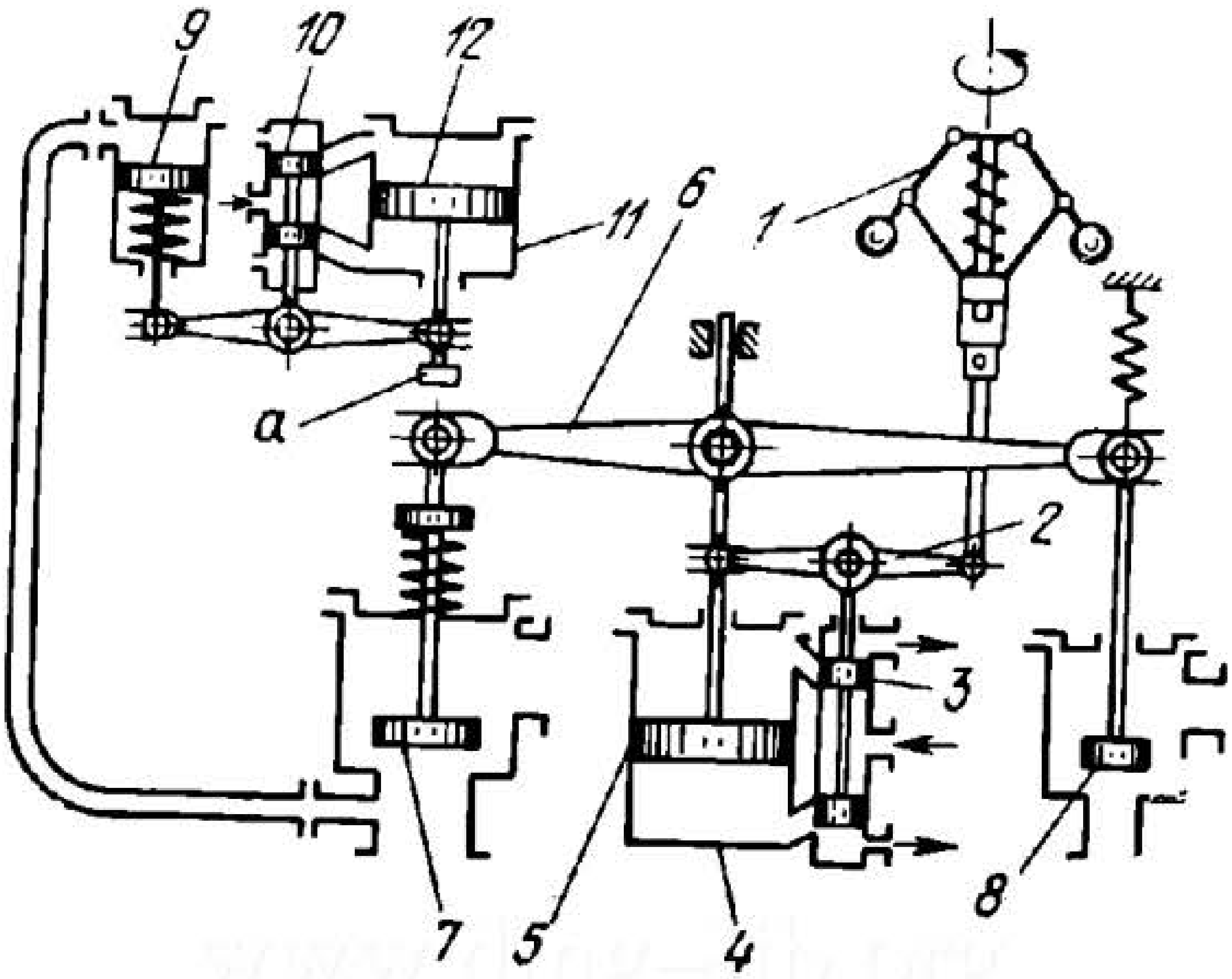
4226	STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM WITH TWO STEAM EXTRACTION UNITS	CHP Rg



Steam extraction

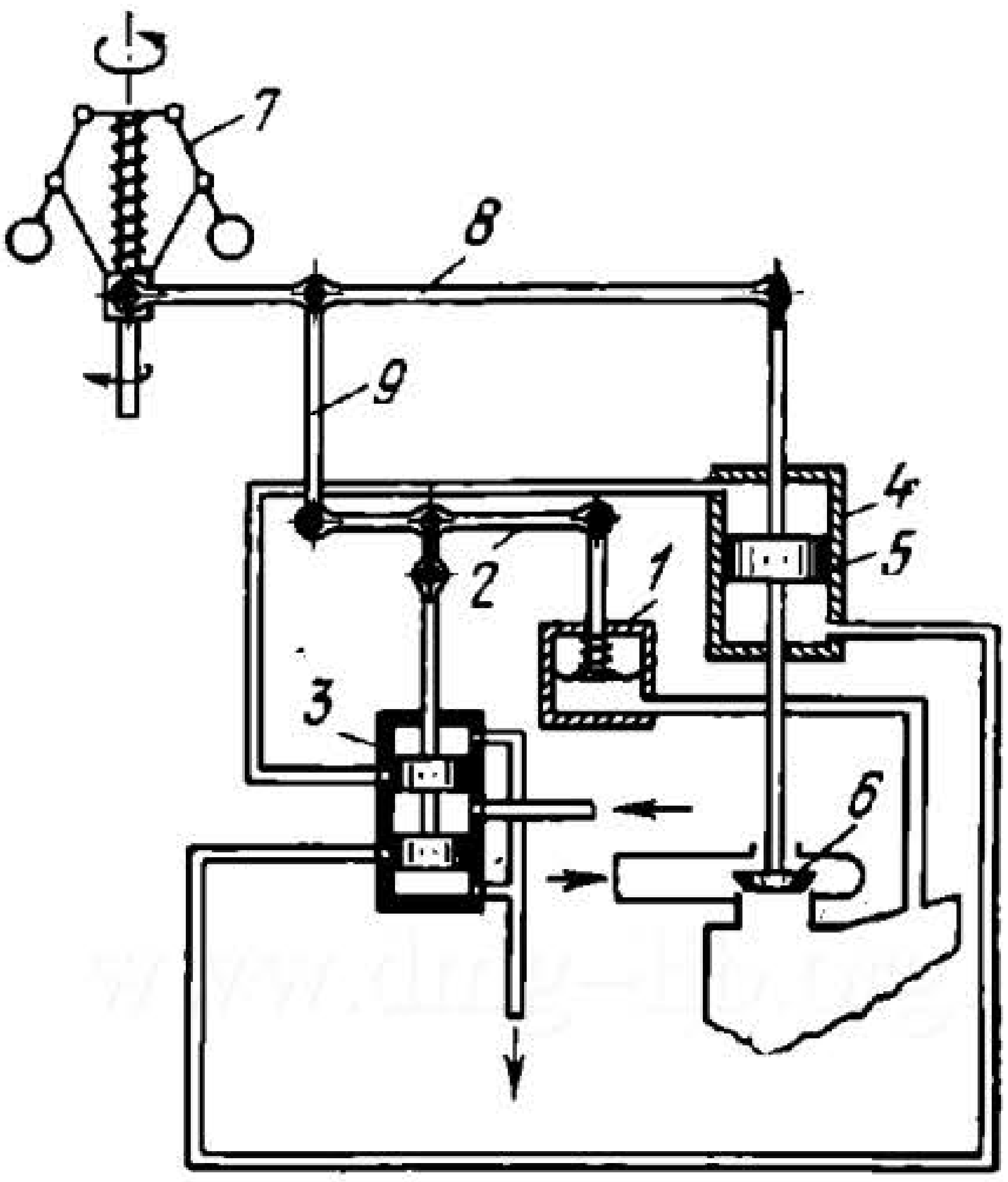
Upon a change in speed of the turbine, the sleeve of centrifugal governor *1* is displaced up or down, thereby shifting, through levers *10*, *11*, *12*, *13*, *14*, *15* and *16*, the spools of three valves, *2*, *3* and *4*, in one direction. This actuates the pistons of servomotors *5*, *6* and *7*, which move three valve members and change the amount of steam admitted into the stages of the turbine. This does not vary the amount of steam being bled off. In case of a change in the amount of steam delivered to the first extraction unit, pressure regulator *8* actuates levers *15* and *16*. This leads to motion of the valve spools of the second and third stage in one direction and the valve spool of the first stage in the other. If the amount of steam delivered to the second extraction unit is changed, second unit pressure regulator *9* actuates motion of the first and second stage valve spools in one direction and the third stage valve spool in the other.

4227	STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM	CHP Rg



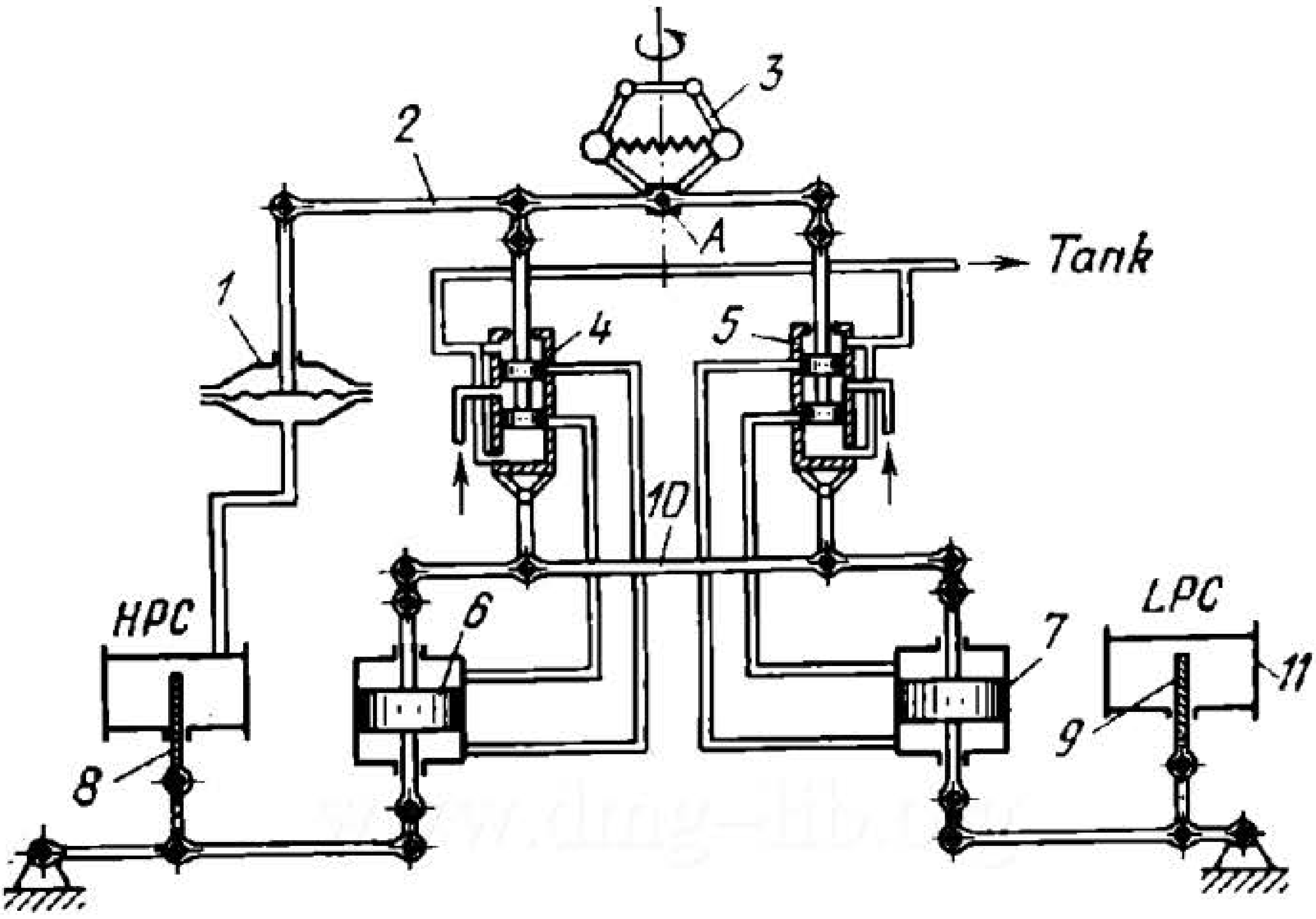
Upon a drop in speed of the shaft being controlled, the sleeve of centrifugal governor *1* moves downward, turning lever *2* which shifts the spool of valve *3*. At this, fluid from the valve is delivered to the lower end of servomotor *4*. Piston *5* moves upward, turning lever *6* and opening valve member *7* which has a weaker spring than valve member *8*. After the stem of valve member *7* reaches stop *a*, valve member *8* begins to open. The opened valve members admit steam at two pressures (live and exhaust steam), thereby increasing the speed of the turbine. Upon an increase in the shaft speed, the elements of the regulator operate in the reverse direction, valve member *8* closing first and then valve member *7*. If the pressure drops in the accumulator or if there is an interruption in the supply of exhaust steam, piston *9* of the pressure regulator moves upward, shifting valve spool *10* upward. Fluid from the valve is delivered to the upper end of servomotor *11*, moving piston *12* downward. This closes valve member *7* and opens valve member *8*, changing over to turbine operation with only live steam.

4228	BACK-PRESSURE STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM	CHP Rg



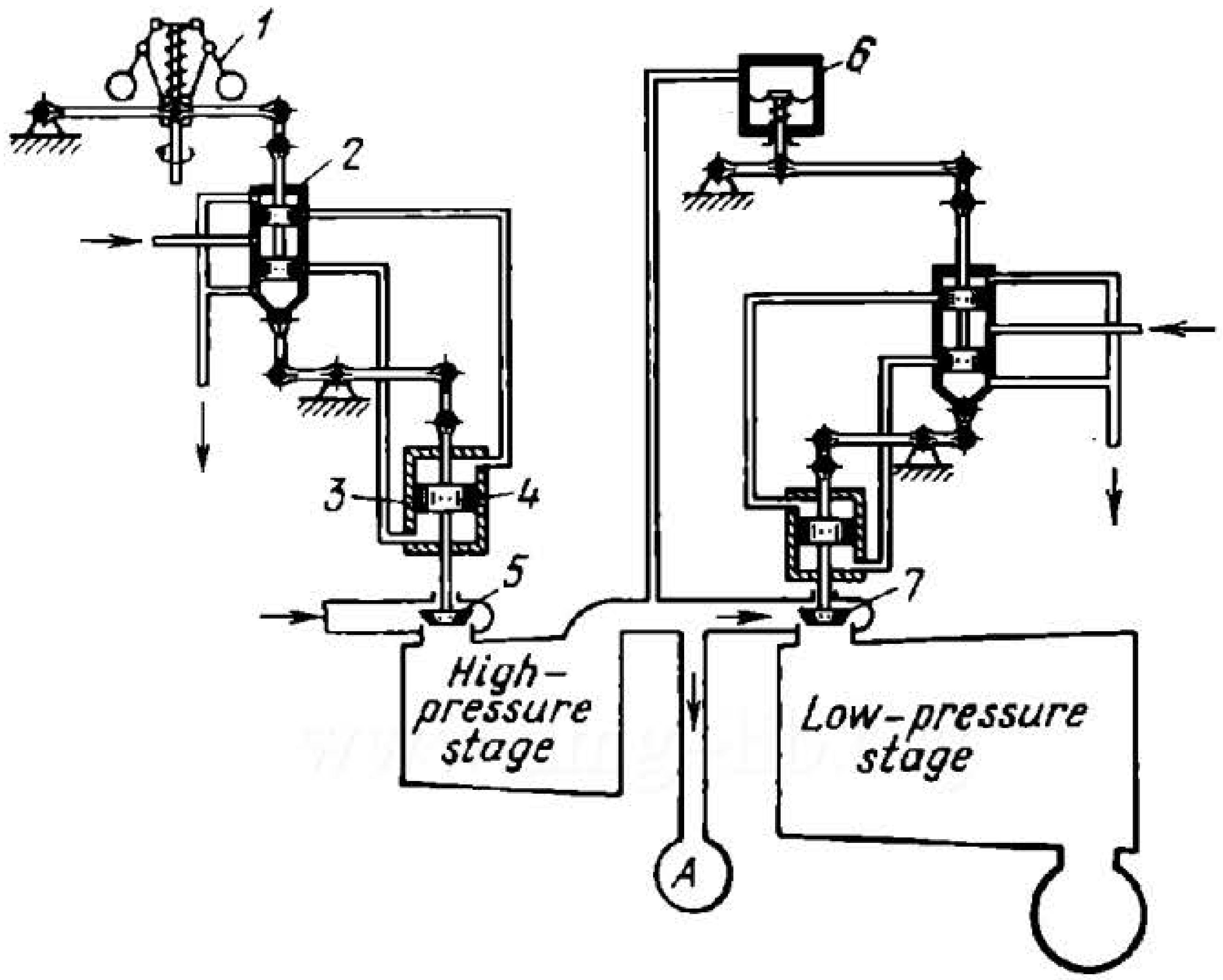
Upon a change in the thermal load in the mains, the pressure acting on regulator *1* changes so that the membrane is bent up or down. This turns lever *2* and shifts the spool of valve *3*. Hydraulic fluid, delivered to the valve, is directed to servomotor *4*, moving piston *5* and regulating member *6* in the required direction. This changes the amount of steam supplied to the turbine. A change in turbine shaft speed actuates centrifugal governor *7*, which shifts the spool of valve *3* through levers *8* and *9*. Fluid from valve *3* is delivered to servomotor *4*, whose piston *5* either opens or closes valve member *6*, which regulates the supply of steam to the turbine.

4229	EXTRACTION STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM	CHP Rg



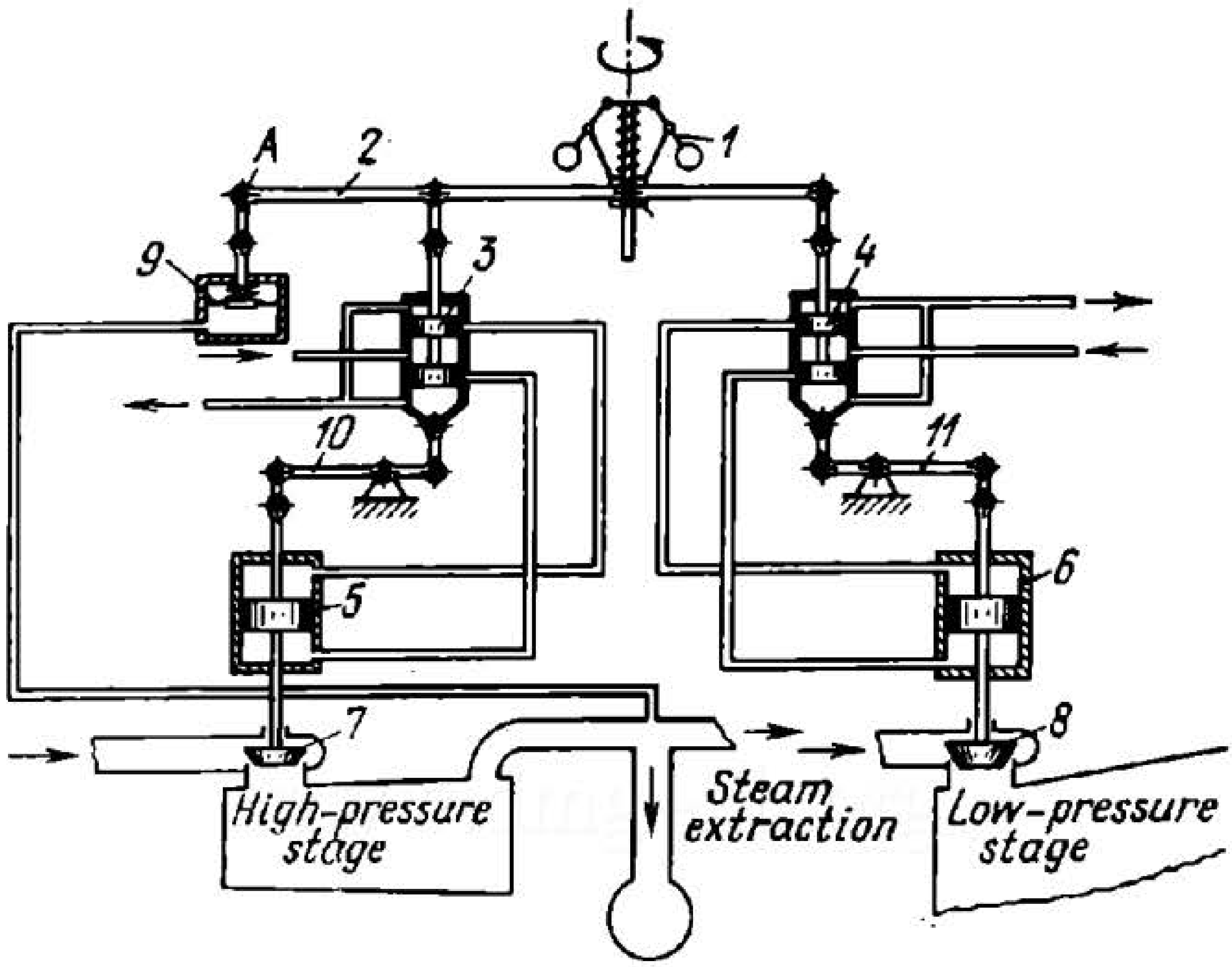
Upon a reduction in thermal load, the pressure increases in the extraction chamber of the turbine and actuates the membrane of pressure regulator *1*, bending it upward. This turns lever *2* about point *A* of the sleeve of centrifugal governor *3*. The spool of valve *4* is shifted upward, and that of valve *5*, downward. Fluid delivered through the bodies of the valves to the servomotors moves pistons *6* and *7*. This closes valve *8* of the high-pressure cylinder (HPC) to some extent, and opens low-pressure valve *9*. Thus, less steam is supplied to the extraction chamber, and the low-pressure cylinder (LPC) *11* uses more steam, also reducing the amount of steam in the extraction chamber. By means of common feedback lever *10*, each servomotor moves the bodies of both valves, so that the valve spools block off their ports. A similar process takes place upon a change in turbine shaft speed and operation of the centrifugal governor *3*, only the spools of valves *4* and *5* shift in the same direction.

4230 | **EXTRACTION STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM** | CHP Rg



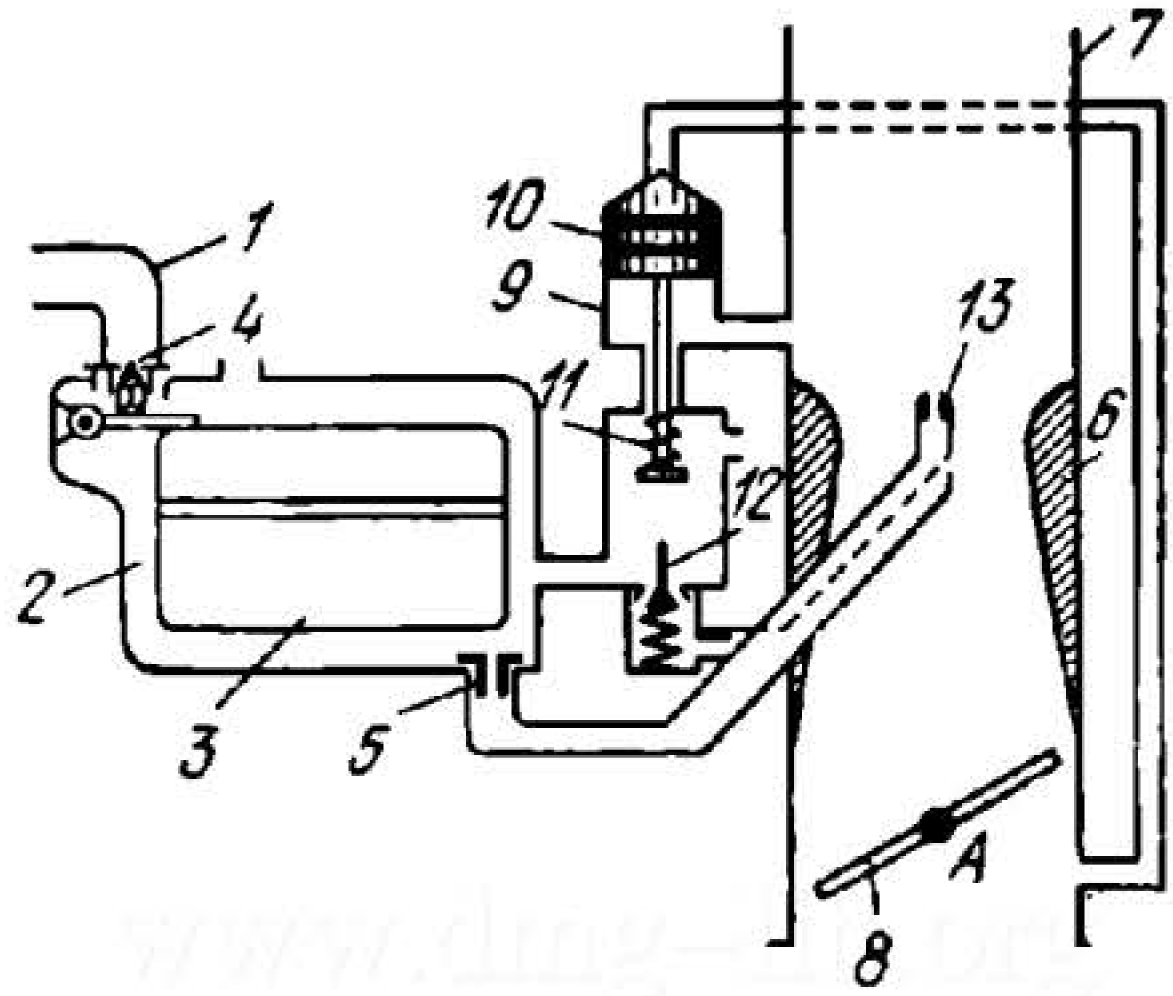
Upon an increase in speed of the shaft being controlled, the sleeve of centrifugal governor *1* moves upward, shifting the spool of valve *2* upward. Hydraulic fluid, delivered to valve *2*, is directed to the upper end of servomotor *3*, moving piston *4* and valve member *5* downward and thereby reducing the supply of steam. This changes the amount of steam flowing into extraction chamber *A* and, consequently, the pressure in the chamber. The change in pressure actuates the membrane of pressure regulator *6*, leading to the shifting of valve member *7*.

4231	EXTRACTION STEAM TURBINE SPEED AND PRESSURE REGULATOR MECHANISM	CHP Rg



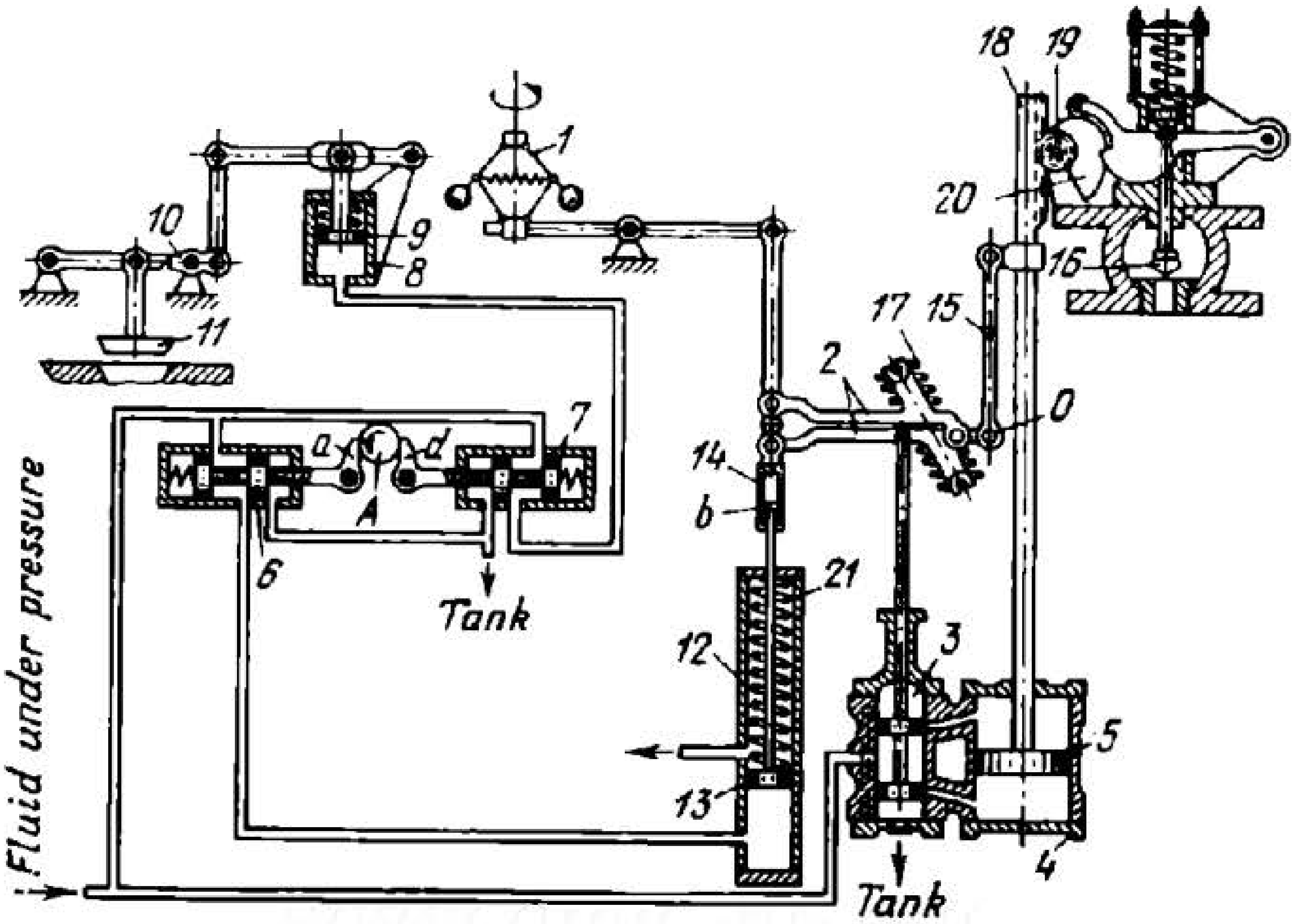
Upon a change in speed of the turbine shaft, the sleeve of centrifugal governor *1* is displaced, turning lever *2* about point *A* and simultaneously shifting the spools of valves *3* and *4*. These valves direct the hydraulic fluid to servomotors *5* and *6*. The movement of the pistons of servomotors *5* and *6* shifts valve members *7* and *8*, changing the amount of steam supplied to the turbine. At this, levers *10* and *11*, performing direct feedback operations, shift the bodies of the valves, returning them to the neutral position. Upon a change in the bled-off steam, pressure regulator *9* turns lever *2*, shifting the spools of valves *3* and *4* and leading to the shifting of valve members *7* and *8*.

4232	AUTOMOBILE CARBURETTOR MECHANISM WITH AN ECONOMIZER	CHP Rg



Fuel is admitted through pipe *1* to chamber *2* containing float *3*, which operates needle valve *4*. From the float chamber, fuel is delivered through jet *5* into the narrow part of venturi *6* where it mixes with air under pressure admitted through jet *13*. The space before throttle valve *8*, turning about fixed axis *A*, is connected to the lower end of economizer cylinder *9*. The space after the throttle is connected to the top of cylinder *9*, containing piston *10*. When the engine is running at medium load, piston *10* is in its upper position due to the considerable difference in pressure. At high loads, the pressure drop over the throttle valve is reduced to the point where piston *10* drops to its lower position due to its dead weight and the action of spring *11*. This opens economizer valve *12* by pushing its member downward, and additional fuel, required at high loads, is supplied to the spray jet.

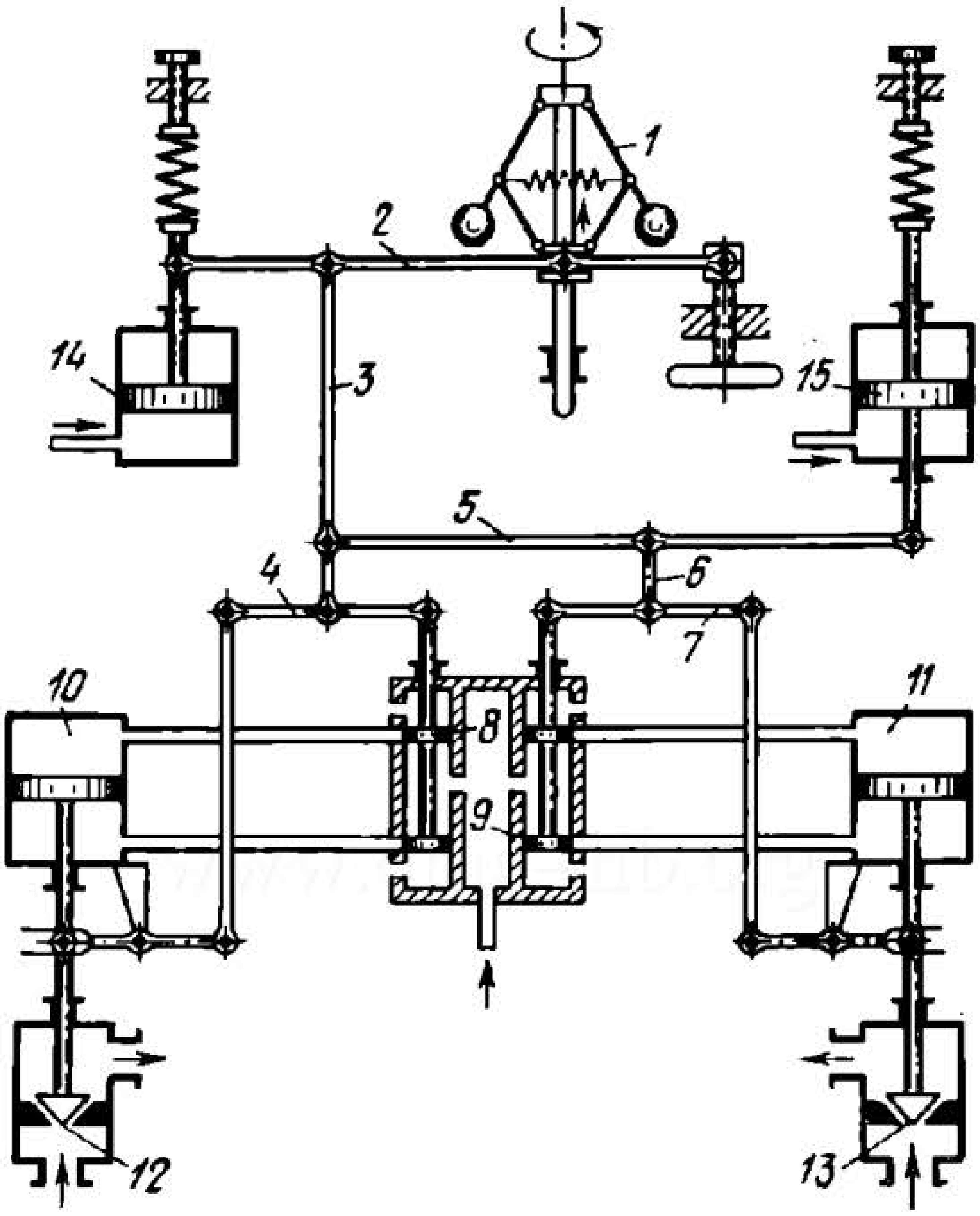
4233	STEAM TURBINE REGULATOR MECHANISM WITH DOUBLE SAFETY CUTOFF	CHP Rg



Upon an increase in speed of the turbine shaft, the sleeve of centrifugal governor *1* moves upward and, through a system of levers, turns levers *2*, held together by spring *17*, about axis *O*. This shifts the spool of valve *3* downward and hydraulic fluid, delivered by the pump to the valve, is admitted to the lower end of servomotor *4*, moving piston *5* upward. At this, gear rack *18* turns pinion *19* and cam *20*, lowering regulating valve member *16*. This reduces the supply of steam to the turbine, thereby reducing its speed. Feedback levers *15* and *2*, connected to the rod of piston *5* and the stem of the spool of valve *3*, return the spool to its central position. Upon a drop in speed of the turbine shaft, the elements of the regulator operate in the reverse direction. Upon normal operation, fluid from the mains passes through valve *7* to the lower end of servomotor *8*, holding piston *9* in the upper position. At this, detent *10* holds starting valve member *11* open, admitting steam into the turbine. At the same time, fluid under pressure, passing through valve *6*, is delivered to cylinder *12*, where it holds piston *13* in the upper position, compressing spring *21*. When the speed of the turbine exceeds the permissible value, a safety switching member, mounted on turbine shaft *A*, actuates levers *a* and *d* of automatic valves *6* and *7*. Lever *d* is released and the spring of valve *7* shifts the spool to the left, disconnecting servomotor *8* from the high-

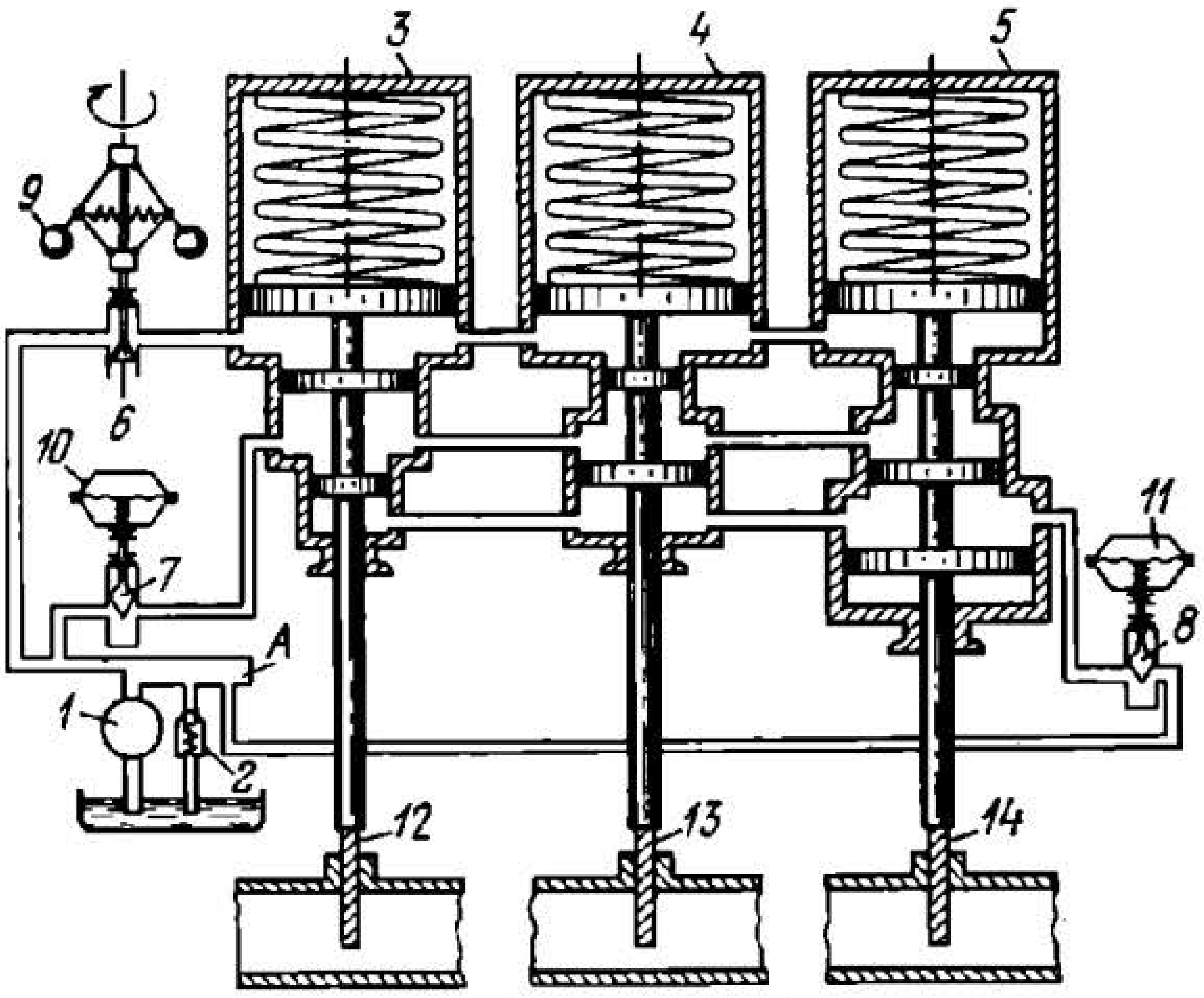
pressure fluid mains and connecting it to the drain. Piston *9* moves downward, detent *10* releases valve member *11*, shutting off steam supply to the turbine. At the same time, the displacement of lever *a* shifts the spool of valve *6*, which connects cylinder *12* to the drain and piston *13* moves downward. Flange *b* at the end of the rod of piston *13* pulls link *14* downward, overcoming the resistance of spring *17*, which holds levers *2* together. The lower lever shifts the spool of valve *3* downward, raising piston *5* of servomotor *4* and closing regulating valve member *16* of the turbine. Thus, the safety switch provides for simultaneous independent closing of both the starting and regulating valve members of the turbine.

4234	BACK-PRESSURE EXTRACTION STEAM TURBINE REGULATOR MECHANISM	CHP Rg



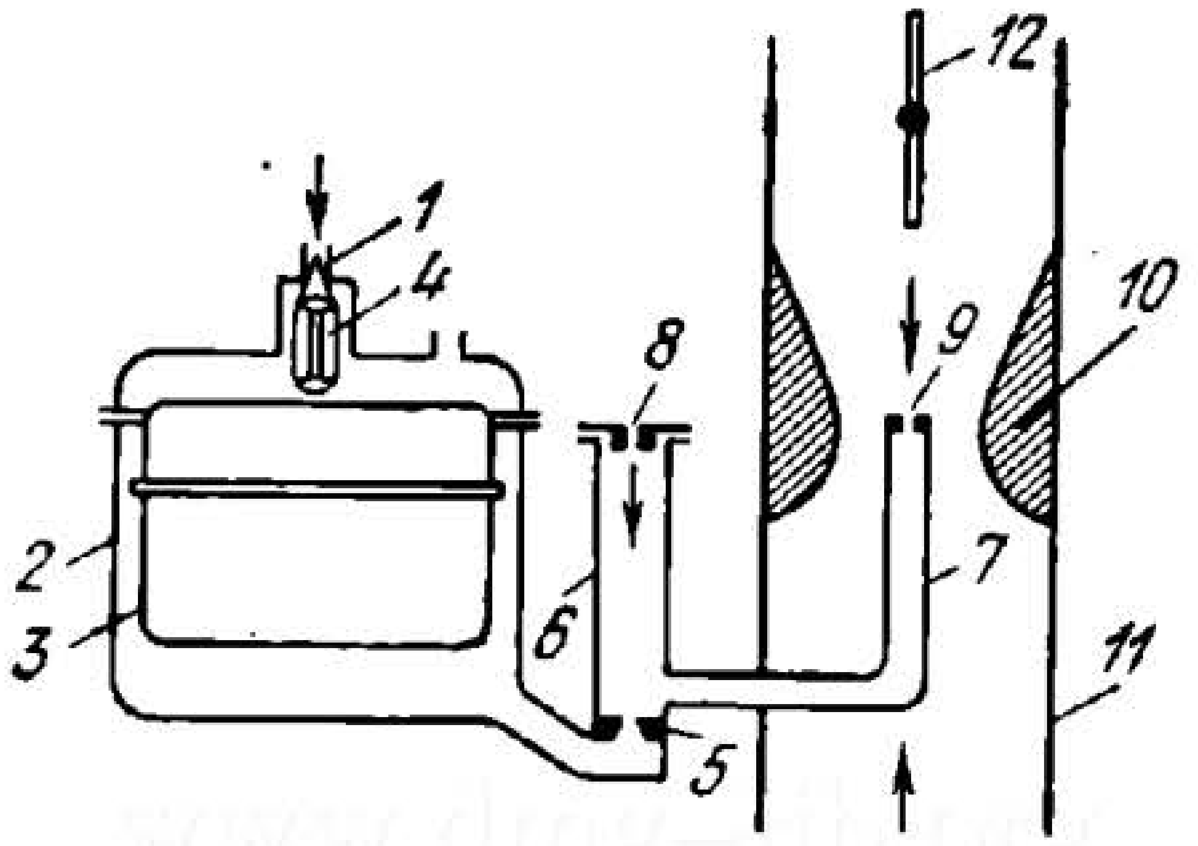
Upon a change in speed of the turbine shaft, the sleeve of centrifugal governor *1* moves upward or downward, shifting the spools of valves *8* and *9* by means of levers *2*, *3*, *4*, *5*, *6* and *7*. This delivers hydraulic fluid to the corresponding ends of servomotors *10* and *11*. The servomotors shift valve members *12* and *13*, which regulate steam supply to the first and second stages of the turbine. The same occurs upon the operation of regulator *14* whose piston is in a position determined by the back-pressure. Extraction regulator *15* operates valve member *13*, which supplies live steam.

4235	STEAM TURBINE REGULATING MECHANISM WITH KETOV AND ARKIN DIFFERENTIAL PISTONS	CHP Rg



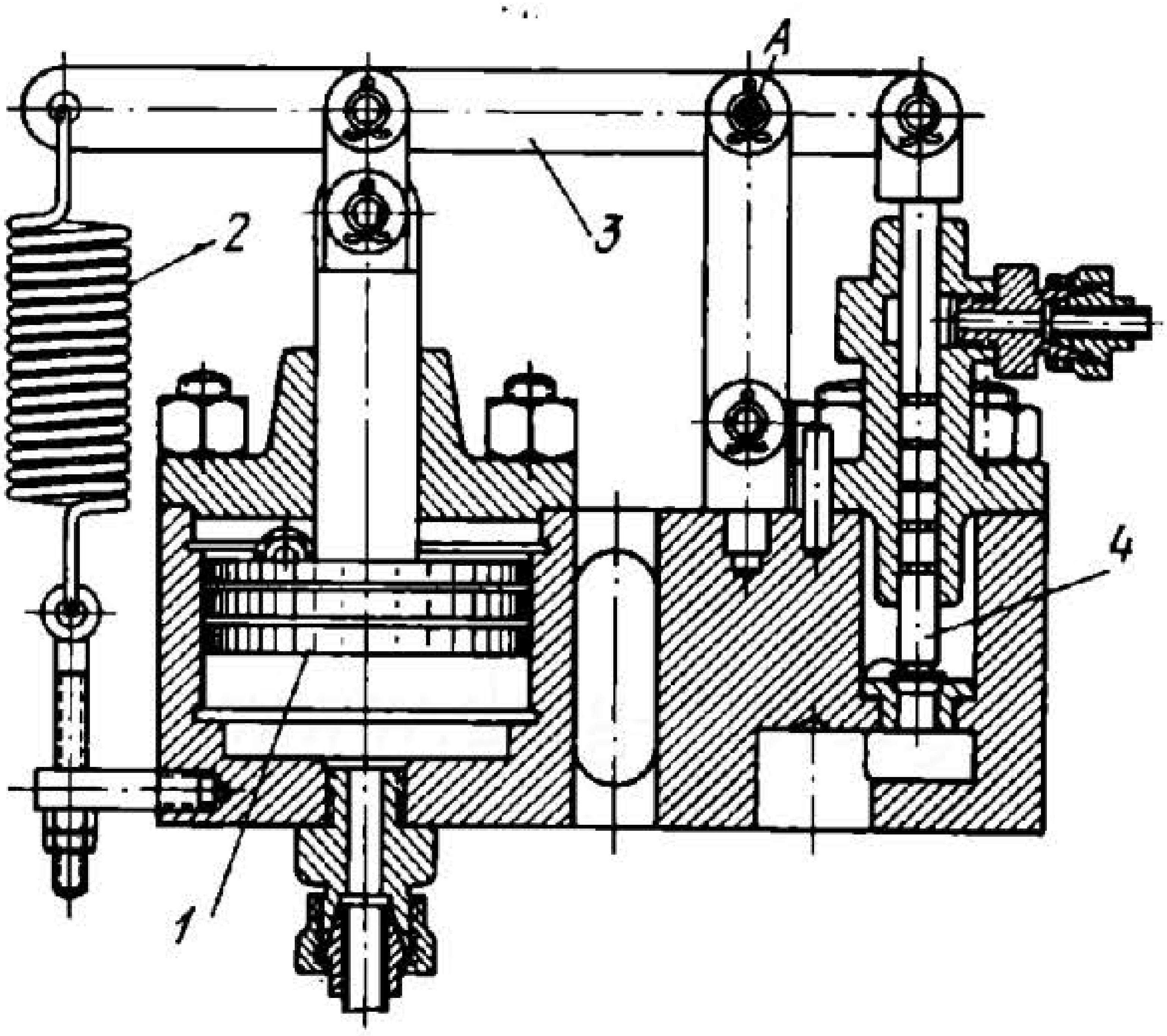
Pump *1* delivers hydraulic fluid under pressure, maintained constant by relief valve *2*, to common chamber *A* and further through pipelines to servomotors *3*, *4* and *5*. Mounted in the pipelines are throttle valves *6*, *7* and *8*, each linked to a regulating device. Regulating devices *9*, *10* and *11* control the speed of the turbine shaft and the pressures at the steam bleeding units. Each regulating device actuates all the servomotors. Upon a drop in turbine shaft speed, the sleeve of centrifugal governor *9* moves downward together with throttle valve *6*, increasing the amount of fluid admitted into servomotor *3*. This raises the pressure in the lower chamber of servomotor *3*, moving its piston upward and opening shutter *12* to increase the supply of steam admitted into the system and, therefore, the speed of the turbine shaft. Shutters *13* and *14* are opened in a similar manner. Upon an increase in turbine shaft speed, the elements of the regulator operate in the reverse direction. Upon a change in pressure in the first extraction chamber, connected to regulating device *10*, shutter *12* moves in the direction opposite to that of shutters *13* and *14*. This is accomplished by the difference in the effective areas of the servomotor pistons. Upon a change in pressure in the second extraction chamber, connected to regulating device *11*, shutters *12* and *13* move in the direction opposite to that of shutter *14*, as is required by the regulating conditions.

4236	MAIN METERING DEVICE MECHANISM OF AN ENGINE	CHP Rg



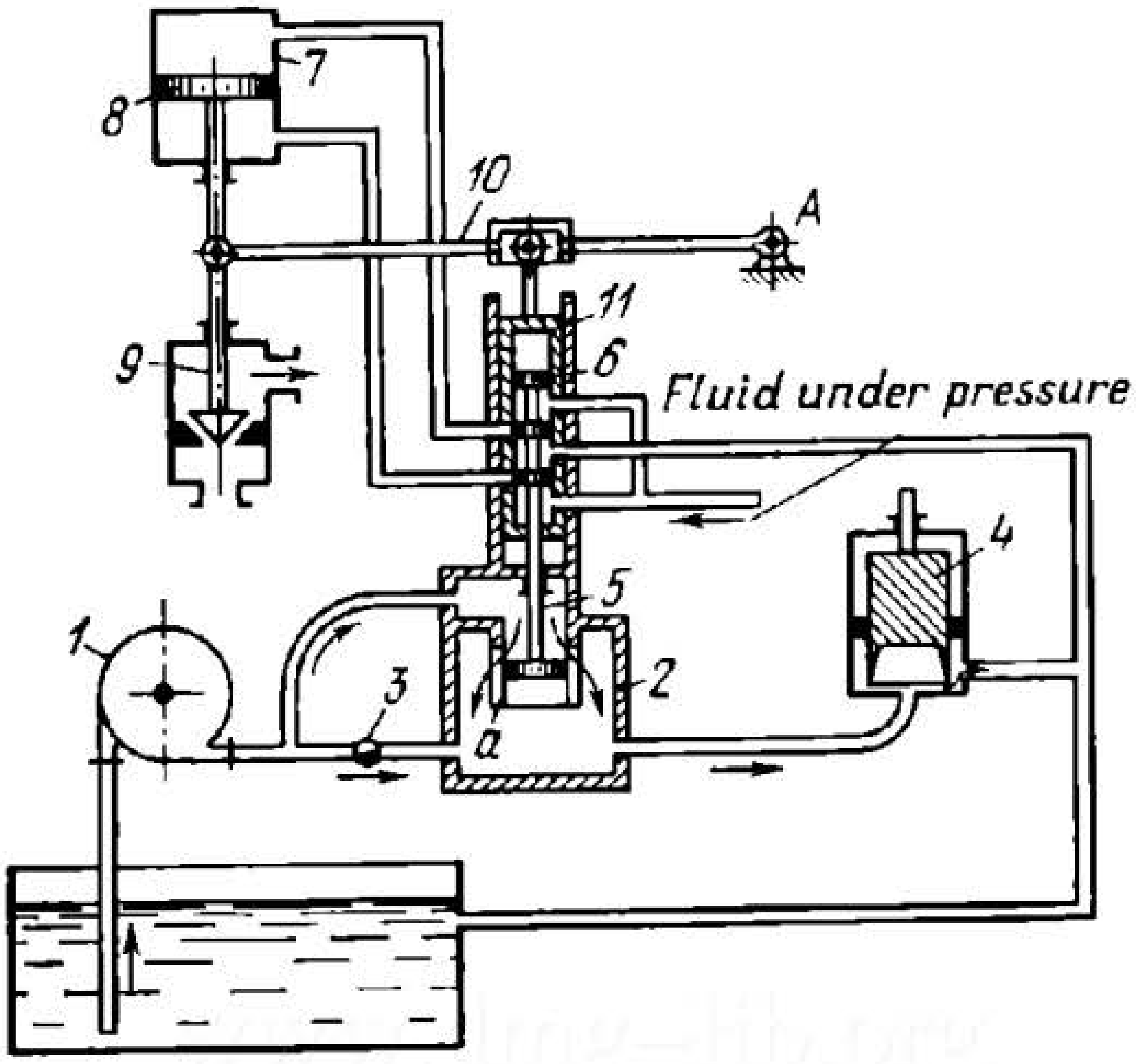
Fuel is admitted through pipe *1* to chamber *2* containing float *3*, which operates needle valve *4*. From the float chamber, fuel is delivered through fuel jet *5* into well *6* and atomizer *7*. The cover of the well has hole *8*. When the engine is not operating, the fuel in the well and atomizer is at the same level as in the float chamber. When the engine begins to operate, pure fuel begins to flow out through jet *9*, arranged in the narrowest part of venturi *10*. The pressure of the incoming air is lowered at the throat of the venturi. The fuel is mixed with air flowing through pipe *11* and forms the fuel-air mixture. When all the fuel in the well is used up, air begins to enter through jet *8* so that an emulsion enters the atomizer instead of pure fuel. Throttle valve *12* regulates the rate of flow of the fuel-air mixture.

4237	STEAM TURBINE LUBRICATING SYSTEM REGULATOR MECHANISM	CHP Rg



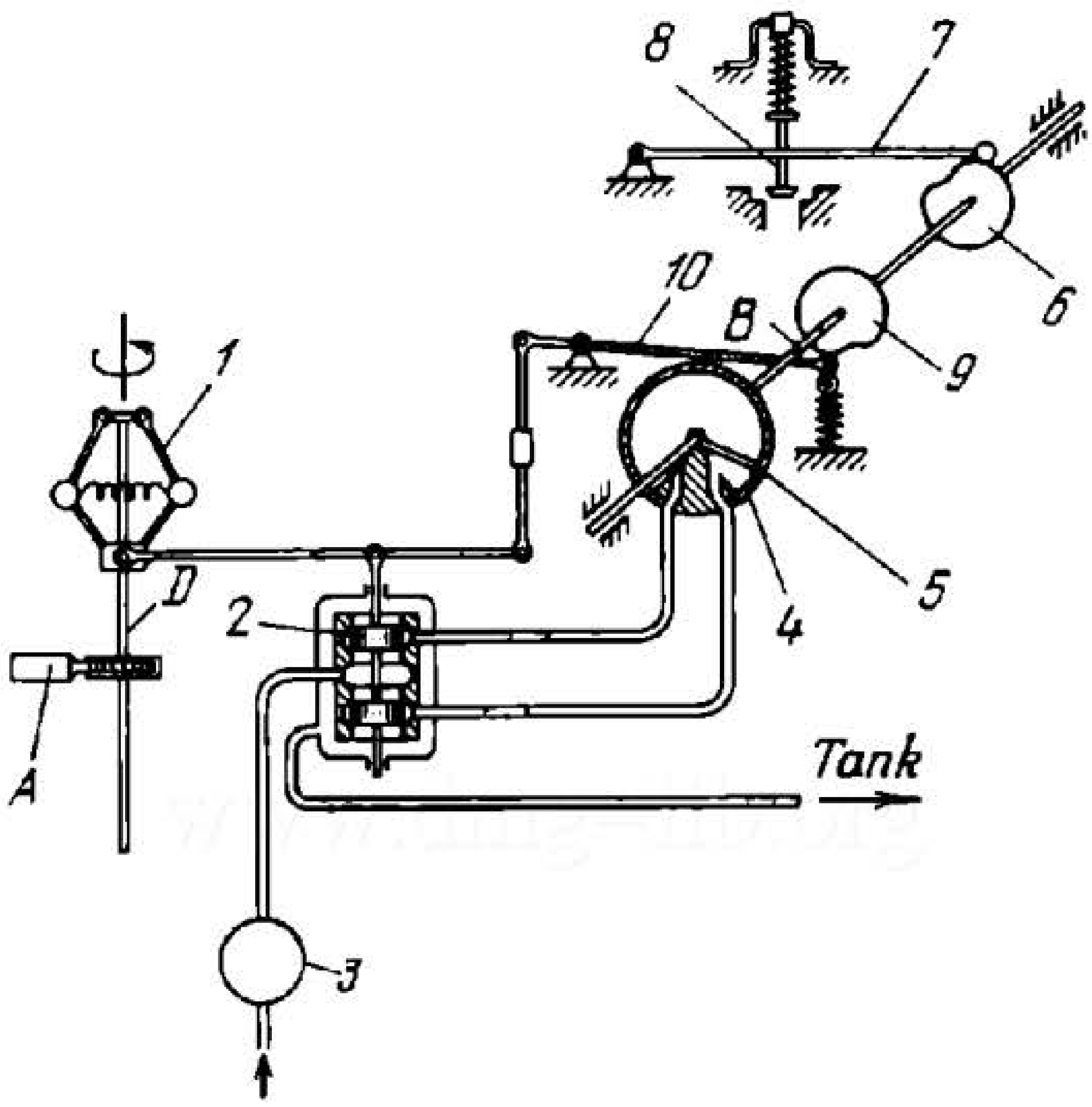
Upon a drop in oil pressure in the turbine lubricating system below the permissible value, piston *1* is moved downward by spring *2*, turning lever *3* about fixed axis *A*. This shifts valve plunger *4* upward, admitting steam into the turbo-pump, which supplies an additional amount of oil to the lubricating system. When the oil pressure increases in the system, piston *1* moves upward, lowering valve plunger *4* and stopping steam supply to the turbo-pump.

4238	STEAM TURBINE SPEED REGULATOR MECHANISM	CHP Rg



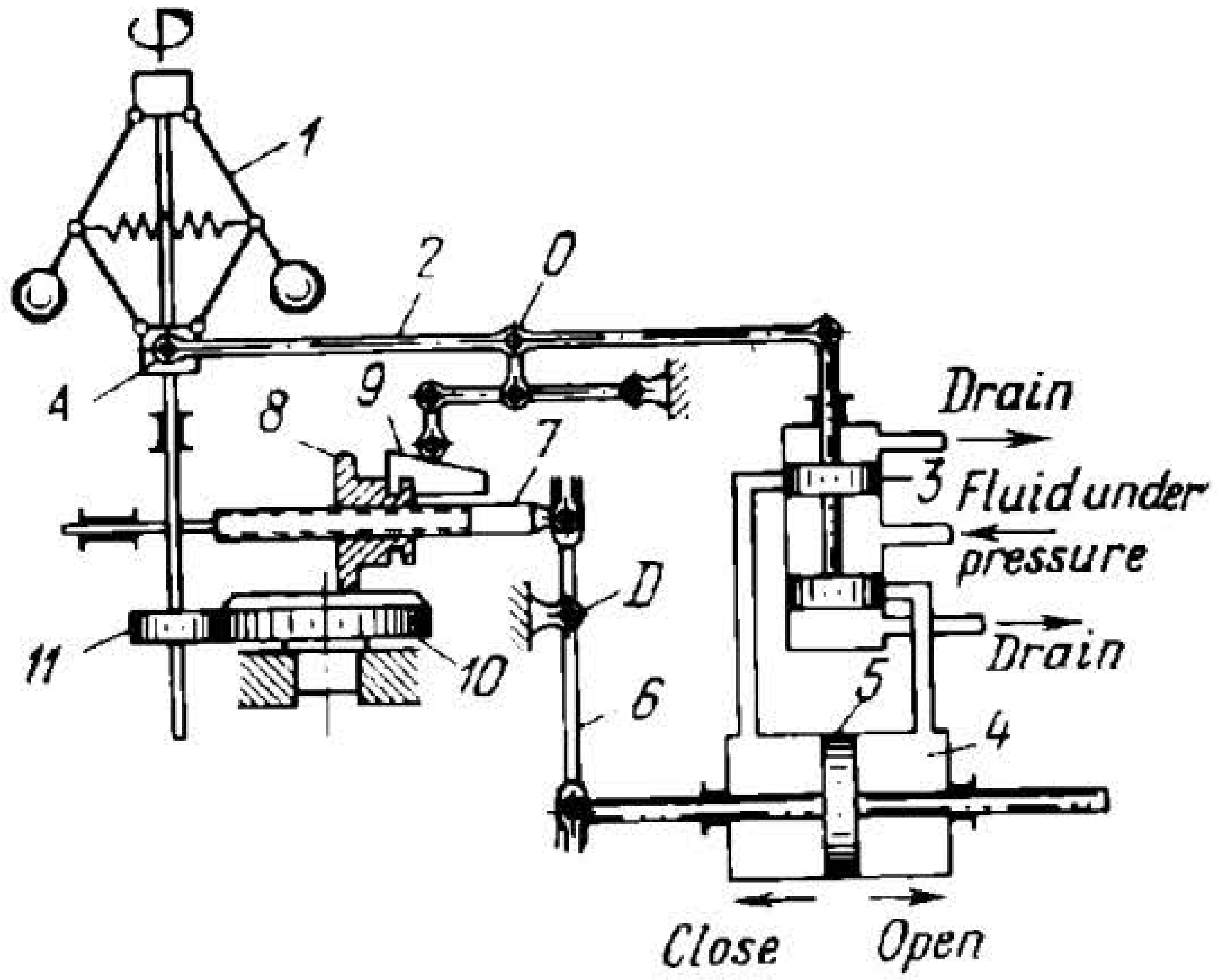
Regulator pump *1*, mounted on the turbine shaft, delivers a part of the hydraulic fluid to the upper end of cylinder *2*, from where it flows down through drain ports *a*, and part through flow-control valve *3* to the lower end of cylinder *2*. Then the fluid passes through pressure-reducing valve *4*, which maintains a constant pressure in the lower end of cylinder *2*. Floating piston *5*, attached to valve spool *6*, is in equilibrium due to the difference in pressure on the two sides of the piston. Upon an increase in turbine shaft speed, the pressure above piston *5* increases due to the increased fluid delivery of pump *1*. Piston *5* and valve spool *6* move downward. This increases the clear opening of drain ports *a*, and equilibrium of piston *5* is restored. As valve spool *6* is shifted downward, fluid delivered to the valve body is directed to the upper end of servomotor *7*, moving piston *8* and valve member *9* downward. This reduces the amount of steam supplied to the turbine, as well as the shaft speed. Piston *8* continues to move downward until feedback lever *10*, turning about fixed axis *A*, shifts sleeve *11* of the valve to its central position with respect to valve spool *6*. Upon a drop in shaft speed, the elements of the regulator operate in the reverse direction. Turbine shaft speed can be varied by regulating flow-control valve *3*.

4239	STEAM TURBINE SPEED REGULATOR MECHANISM	CHP Rg



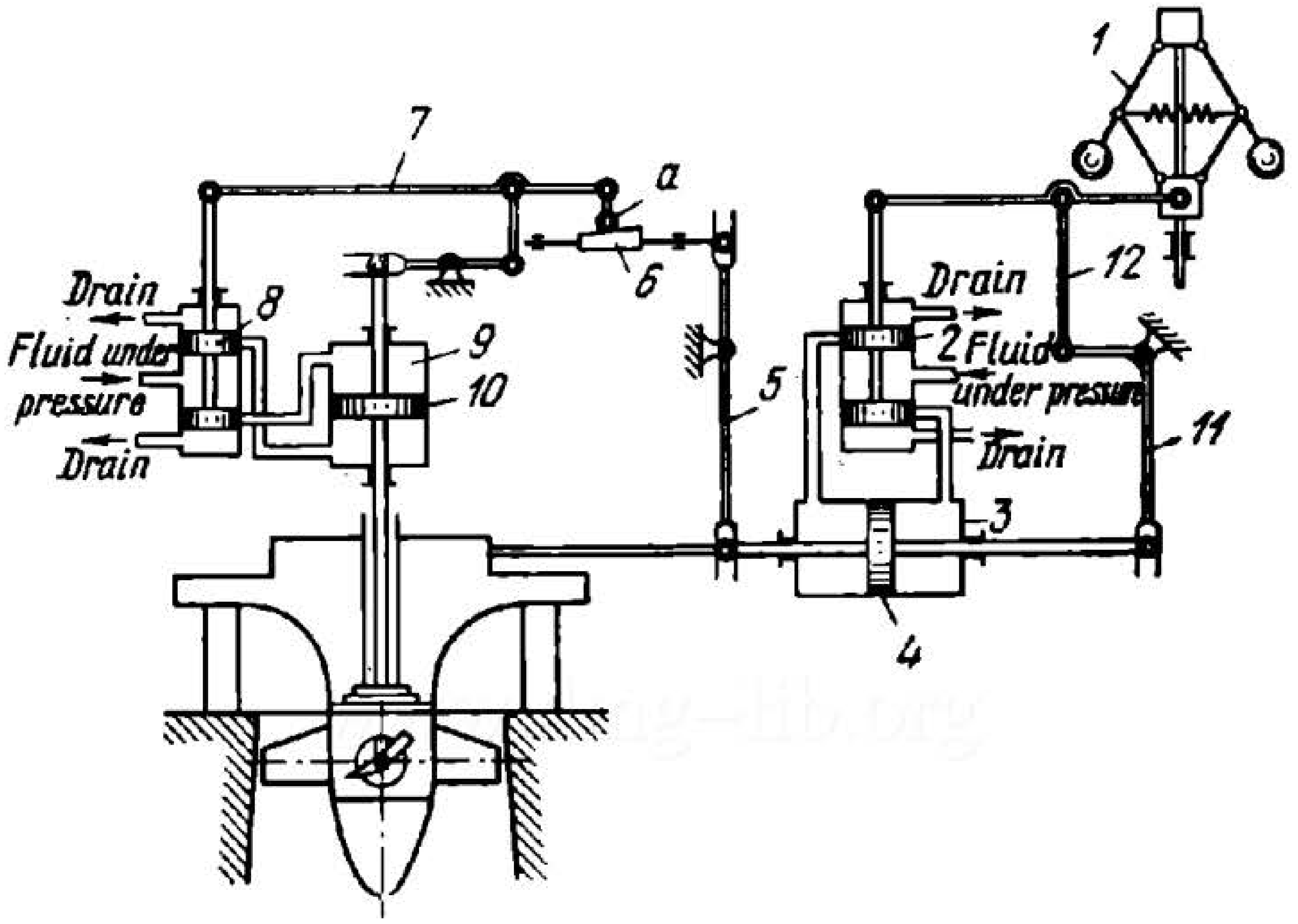
Upon an increase in speed of turbine shaft *A* and of shaft *D*, connected to shaft *A* by worm gearing, the weights of centrifugal governor *1* move outward and its sleeve moves upward, shifting valve spool *2* upward as well. At this, hydraulic fluid delivered by pump *3* to the valve is directed to rotary servomotor *4*. The fluid turns servomotor vane *5* together with shaft *B*, whose axis is perpendicular to the planes of cams *6* and *9*. Fluid from the exhaust chamber of the servomotor is discharged through a groove of spool *2* to the tank. As shaft *B* turns with cam *6*, lever *7* turns clockwise, lowering valve member *8*. This reduces the supply of steam to the turbine and its shaft speed decreases. Also turned is cam *9*, controlling feedback lever *10*, which returns valve spool *2* to its central position. Upon a reduction in the speed of the turbine shaft, the elements of the regulator operate in the reverse direction.

4240	LEVER-FRICTION MECHANISM OF A HYDRAULIC TURBINE SPEED REGULATOR	CHP Rg



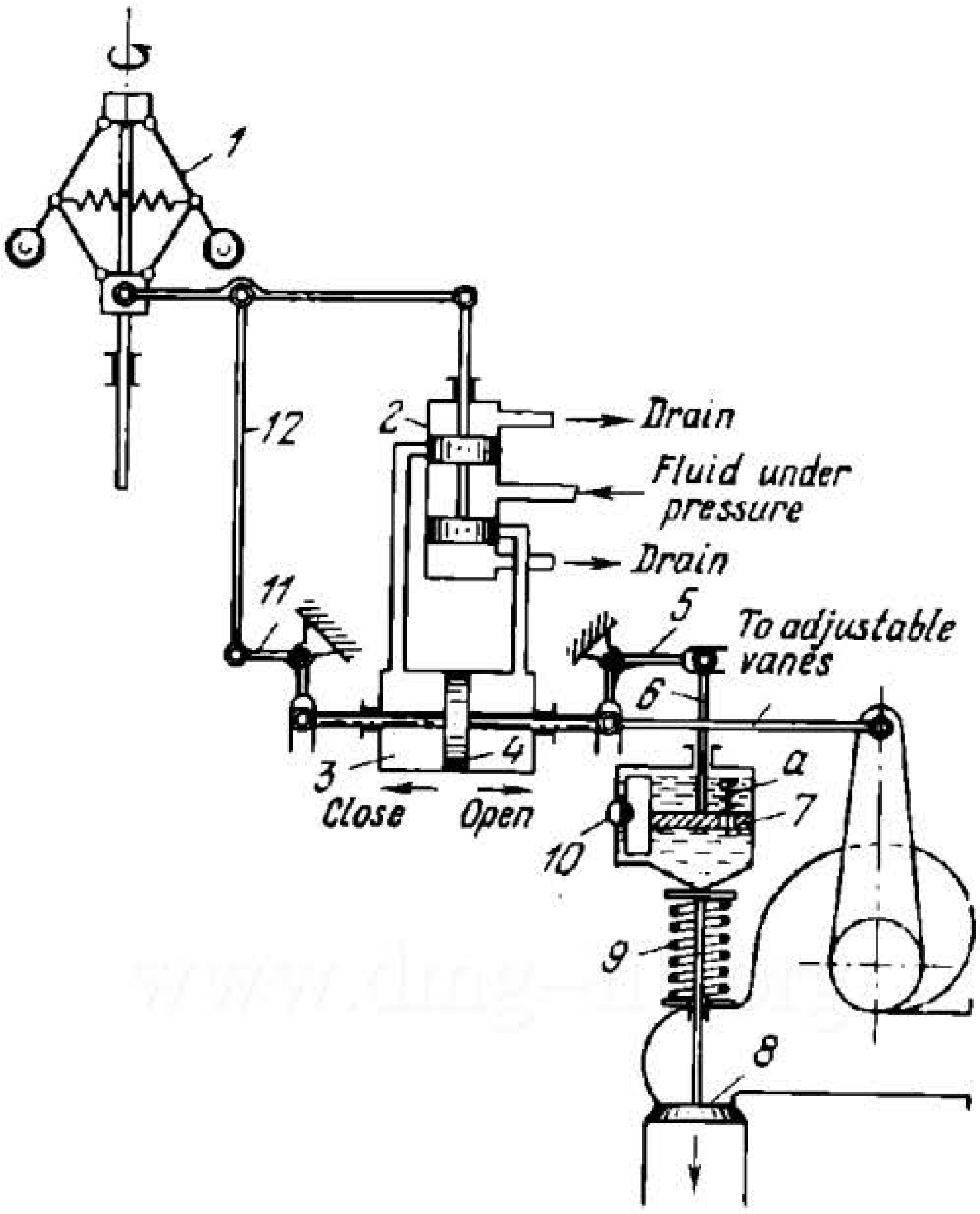
Upon an increase in speed of the turbine shaft being controlled, the weights of centrifugal governor *1* move outward and its sleeve moves upward. This turns lever *2* about point *O*, shifting the spool of valve *3* downward. Hydraulic fluid from valve *3* is admitted to the right end of servomotor *4*, moving piston *5* to the left, thereby closing the regulating member of the turbine and reducing the shaft speed. At the same time, the rod of piston *5* turns lever *6* about fixed axis *D*. At this, spindle *7*, together with friction wheel *8* and cam *9*, is shifted to the right, turning lever *2* about point *A* to return the spool of valve *3* to its central position. The gear rim of friction plate *10* meshes with gear *11*, which rotates continuously with the governor shaft. Friction wheel *8*, being displaced from the centre of friction plate *10*, rotates on the thread of the spindle and therefore travels axially toward the centre of friction plate *10*. This shifts cam *9*, linked to wheel *8*, shifting the directional valve spool downward to block off fluid delivery. The regulating process continues until friction wheel *8* returns to the centre of friction plate *10*, and point *O* is thereby returned to its initial position. As the speed of the turbine shaft decreases, it reaches its normal value. Piston *5* of the servomotor occupies the position corresponding to the new load on the turbine.

SPEED AND BLADE-ANGLE REGULATOR MECHANISM FOR A HYDRAULIC TURBINE RUNNER



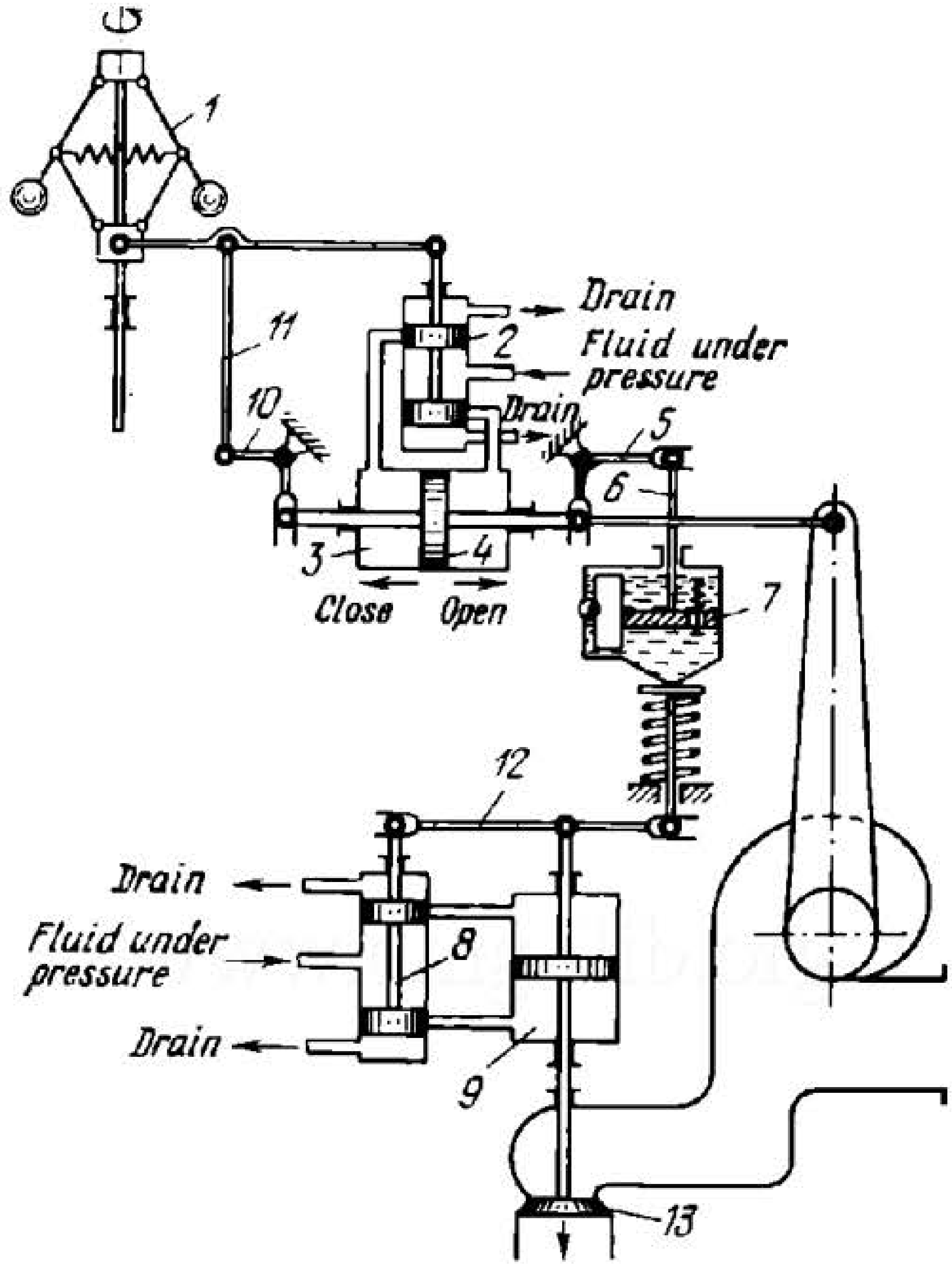
Upon a change in speed of the hydraulic turbine runner, the sleeve of centrifugal governor *1* moves up or down, shifting valve spool *2*. Hydraulic fluid from the valve is directed to servomotor *3* and moves piston *4*, which changes the position of the guiding device blades. Motion of piston *4* also turns lever *5*, shifting cam *6*. Roller *a* rolls along cam *6* and lever *7* shifts valve spool *8*. Fluid from the valve is directed to servomotor *9*, moving piston *10*, which turns the turbine runner blades. Feedback levers *11* and *12*, return spool *2* to the central position. Thus, each load or each position of the guiding device blades corresponds to the optimum angle of the runner blades.

4242	SPEED REGULATOR MECHANISM OF A HYDRAULIC TURBINE WITH AN IDLE-DRAIN FEATURE	CHP Rg



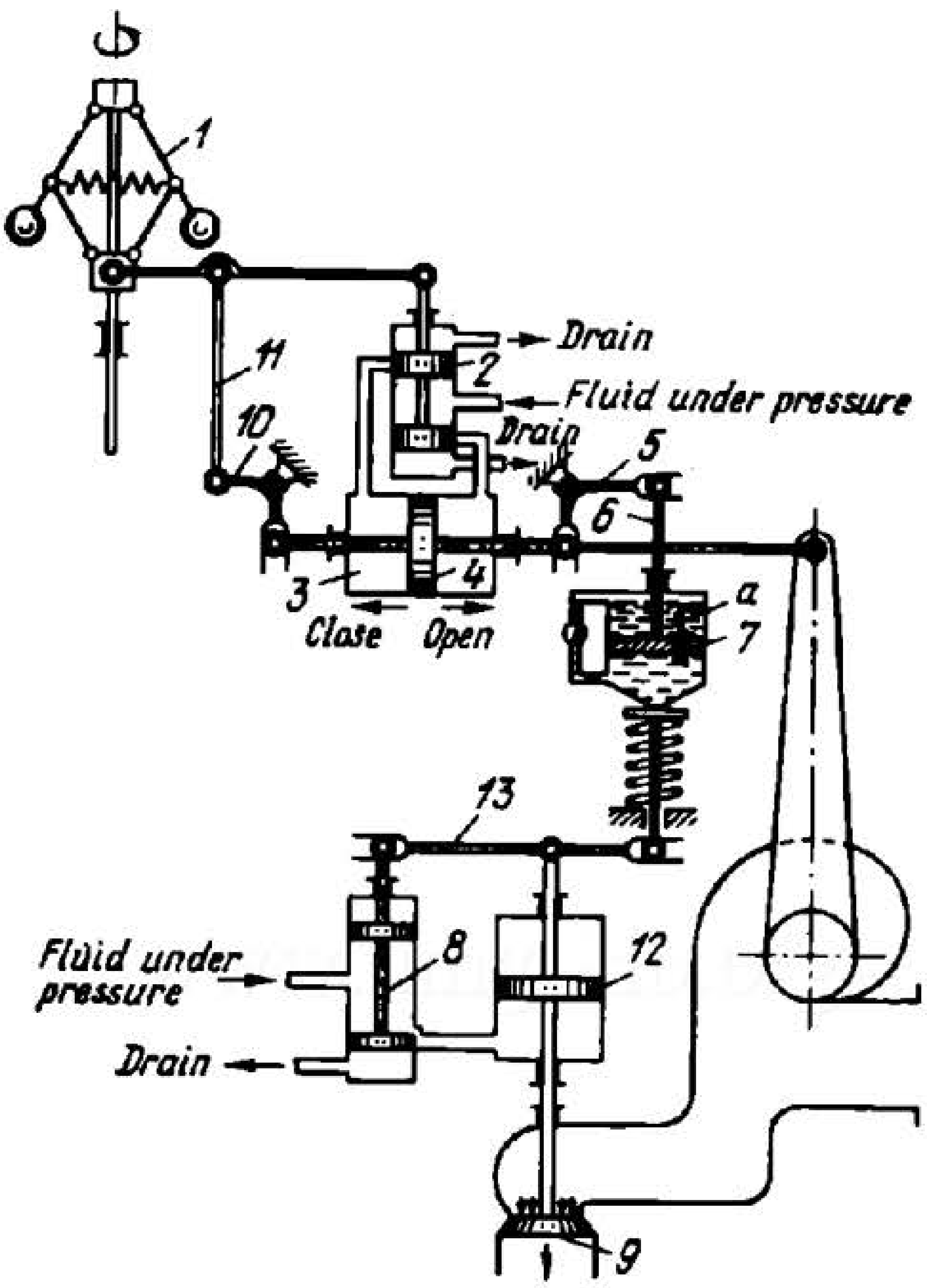
Upon an increase in speed of the hydraulic turbine runner, the sleeve of centrifugal governor *1* moves upward, shifting the spool of valve *2* downward. Hydraulic fluid from valve *2* is directed to servomotor *3*, moving piston *4* to the left. This changes the position of the regulating member and the speed is reduced. At the same time, when piston *4* is moving in the closing direction, bell-crank lever *5* and rod *6* move piston *7* of the idle-drain cataract downward. The cataract housing also moves downward, opening idle-drain valve member *8*. At this, the required amount of water is drained from the inlet volute chamber to prevent water hammer. Then, spring *9* moves piston *7* of the cataract slowly upward, lifting idle-drain valve *8*. At this, fluid slowly flows through flow-control valve *10* from the lower to the upper end of the cataract housing. The velocity of piston return is regulated by means of flow-control valve *10*. Feedback levers *11* and *12* return the spool of valve *2* to its central position. When piston *4* moves in the opening direction for the regulating member, upon a reduction in turbine runner speed, idle-drain valve *8* remains closed. This is accomplished by the provision of check valve *a* in cataract piston *7*.

4243	SPEED REGULATOR MECHANISM OF A HYDRAULIC TURBINE WITH AN IDLE-DRAIN FEATURE	CHP Rg



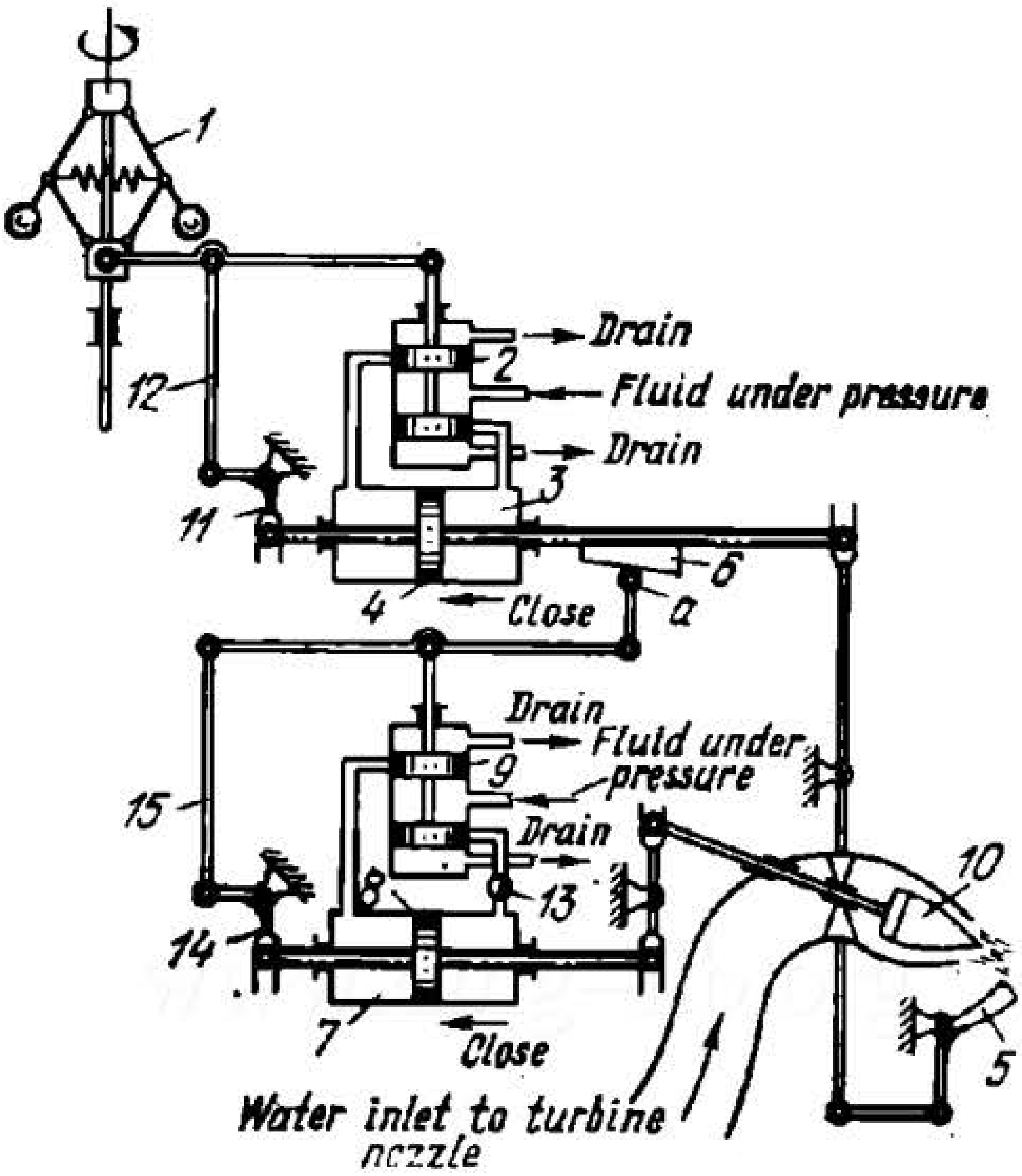
Upon a change in speed of the hydraulic turbine runner, the sleeve of centrifugal governor *1* moves up or down, shifting valve spool *2*. Hydraulic fluid from the valve is directed to servomotor *3* and moves piston *4*, which changes the position of the regulating member. At the same time, when piston *4* is moving in the closing direction, bell-crank lever *5* and rod *6* move piston *7* of the idle-drain cataract downward. Through lever *12*, this shifts valve spool *8* upward. Fluid from the valve is directed to servomotor *9*, moving its piston downward and opening idle-drain valve member *13*. At this, the required amount of water is drained from the inlet volute chamber to prevent water hammer. Feedback levers *10* and *11* return valve spool *2* to its central position. The idle-drain valve member closes slowly due to throttling of the fluid flowing from one end of the cataract housing to the other. When the regulating member is moved in the opening direction, the idle-drain valve member is not opened because a check valve is provided in cataract piston *7*.

4244	SPEED REGULATOR MECHANISM OF A HYDRAULIC TURBINE WITH AN IDLE-DRAIN FEATURE	CHP Rg



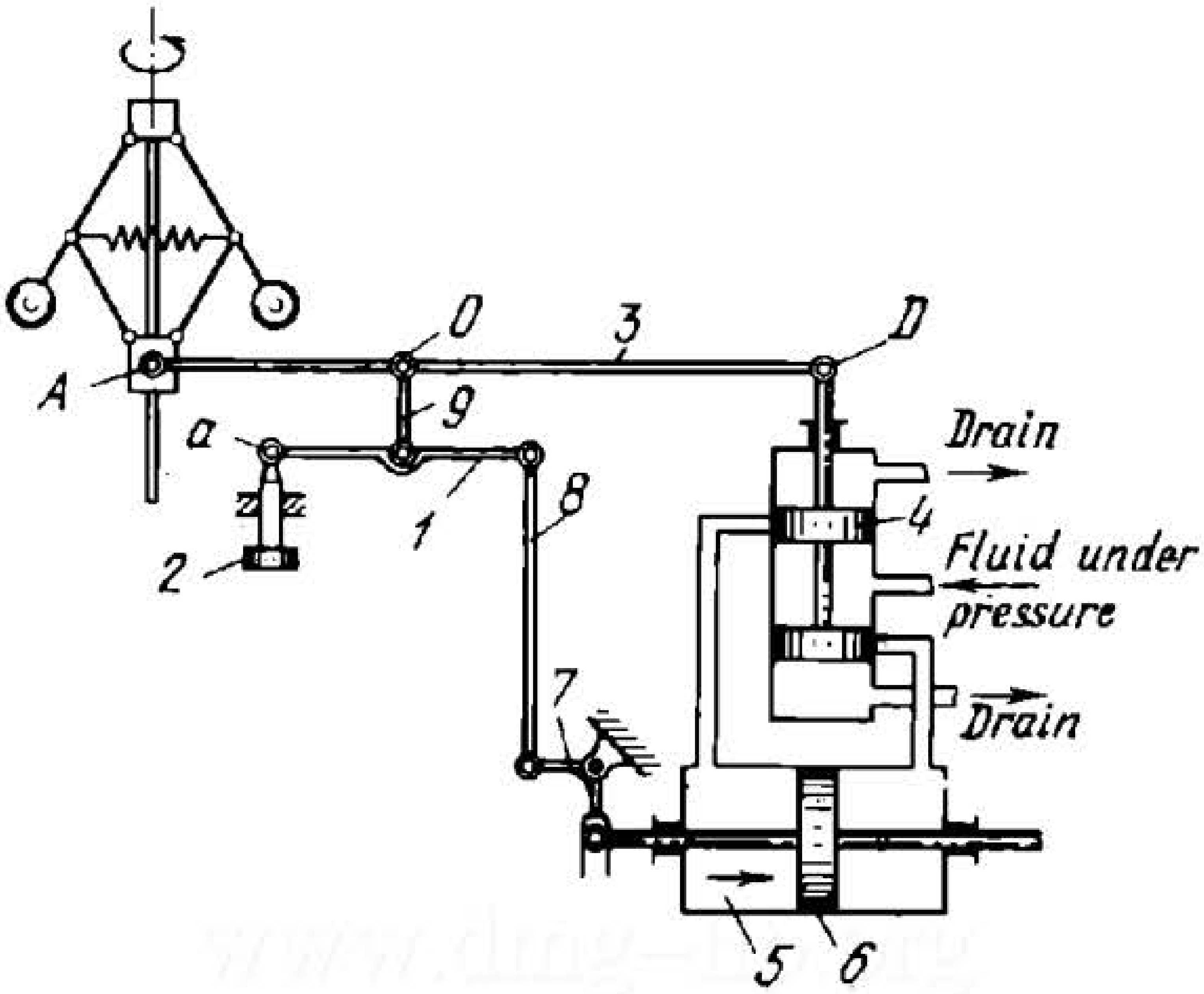
Upon an increase in speed of the hydraulic turbine runner, the sleeve of centrifugal governor 1 moves upward, shifting the spool of valve 2 downward. Hydraulic fluid from valve 2 is directed to the right end of servomotor 3, moving piston 4 to the left. This changes the position of the regulating member and the speed is reduced. At the same time, when piston 4 is moving in the closing direction, bell-crank lever 5 and rod 6 move piston 7 of the idle-drain cataract downward. The cataract housing moves rapidly downward and, through lever 13, shifts valve spool 8 upward. With the guiding device stationary, idle-drain valve member 9 is held closed by piston 12 of the servomotor, under which valve spool 8 directs fluid under pressure. For this purpose, the valve has negative overlap, i.e. a narrow opening between the land of the spool and the delivery port. When valve spool 8 moves upward, the lower end of the servomotor is connected to the tank, piston 12 moves downward and idle-drain valve member 9 opens. At this, the required amount of water is drained from the inlet volute chamber to prevent water hammer. Feedback levers 10 and 11 return valve spool 2 to its central position. When valve spool 8 returns to its initial position, fluid under pressure is delivered again under piston 12, moving it upward. Valve member 9 closes slowly because it must overcome hydraulic resistance. Upon a reduction in turbine runner speed, valve member 9 remains closed. This is accomplished by the provision of check valve *a* in cataract piston 7.

4245	SPEED REGULATOR MECHANISM OF A HYDRAULIC TURBINE WITH A DEFLECTOR	CHP Rg



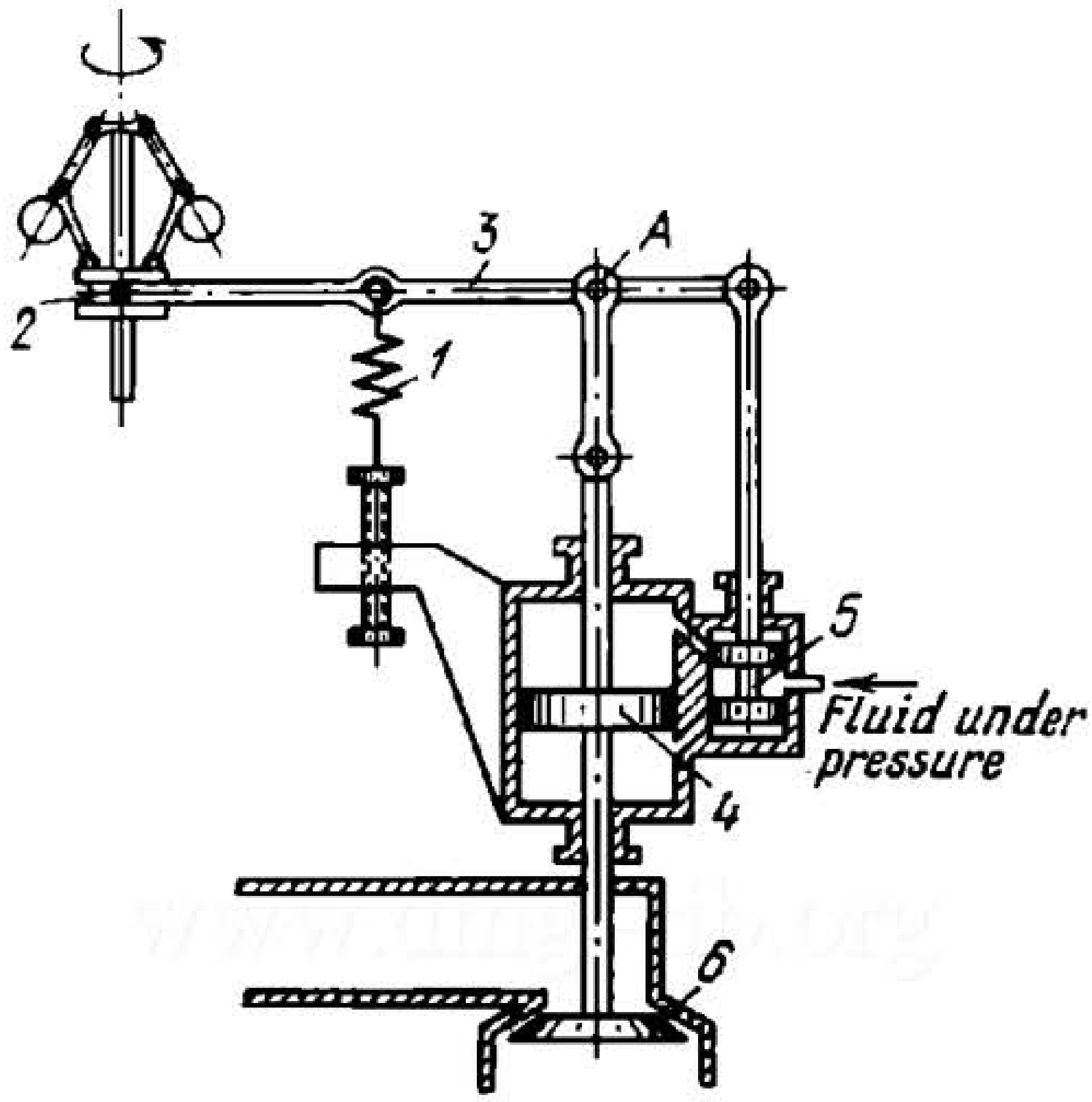
Upon an increase in the speed of the hydraulic turbine runner, the sleeve of centrifugal governor *1* moves upward, shifting valve spool *2* downward. Hydraulic fluid from the valve is directed to the right end of servomotor *3*, moving piston *4* to the left, in the direction in which the regulating member is closed. At this, deflector *5*, linked by a lever system to the rod of piston *4*, cuts into the jet from the nozzle, deflecting a part from the runner and thereby reducing its speed. Cam *6* actuates roller *a*, shifts valve spool *9* downward, and fluid from the valve is directed to the right end of servomotor *7* through flow-control valve *13*. This moves piston *8* to the left, in the direction in which the opening in the nozzle is closed to some extent by throttling needle *10*, thereby reducing the rate of flow through the nozzle. Owing to the provision of flow-control valve *13*, the needle moves slowly to prevent a drastic increase in water pressure in the inlet pipeline. Feedback levers *11* and *12*, as well as *14* and *15*, return valve spools *2* and *9* to their central positions.

4246	REGULATOR MECHANISM WITH A TURBINE SPEED-CHANGING DEVICE	CHP Rg



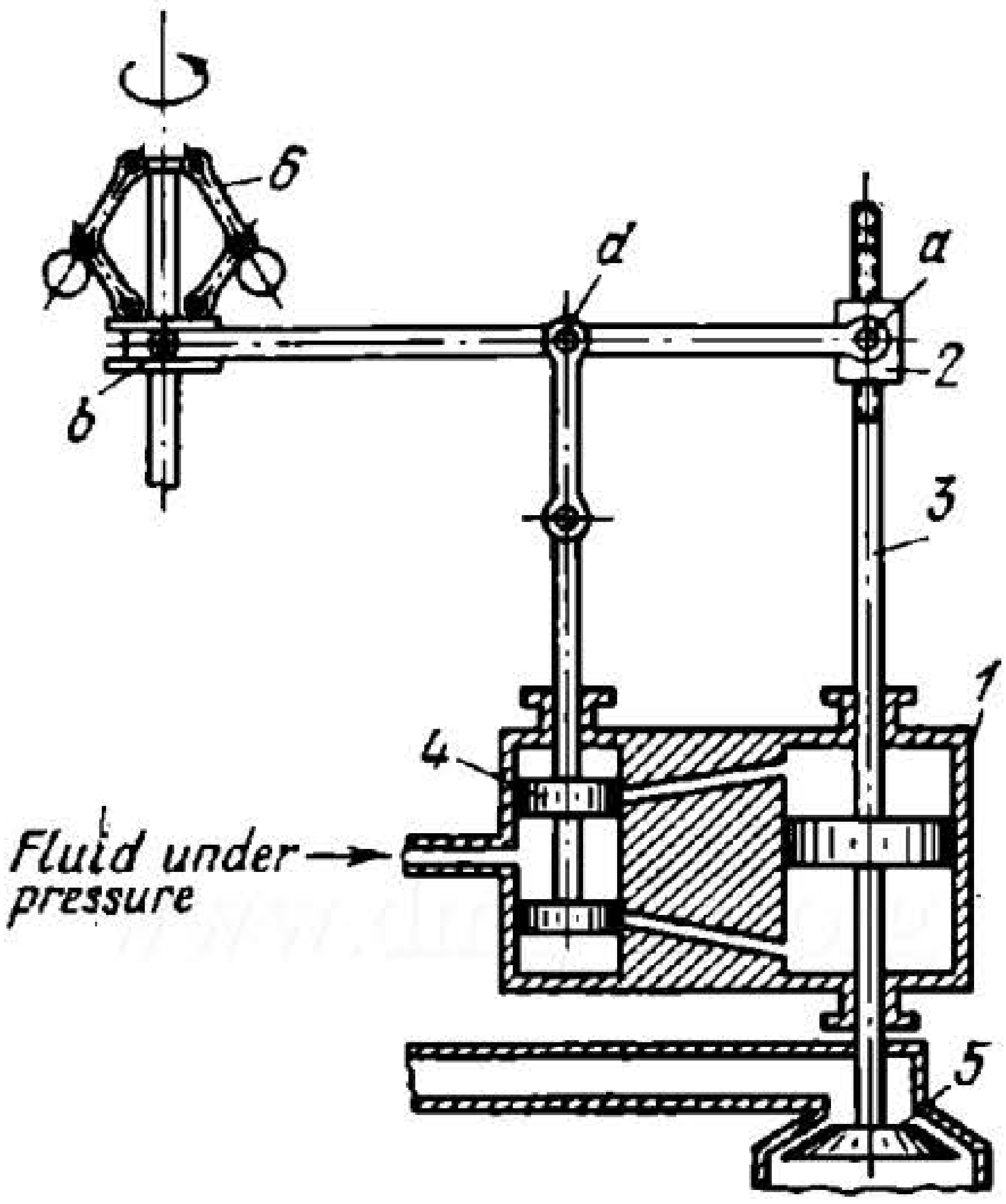
The regulator system has additional lever *1* provided for changing the turbine shaft speed. Point *a* of lever *1* is linked to the end of screw *2* in such manner that pivot *O* of lever *3* can be adjusted by turning screw *2*. This shifts valve spool *4* so that piston *6* of servomotor *5* moves the regulating member in the direction of either opening or closing. To raise the turbine speed at constant load, point *a* is displaced upward. At this, pivot *O* and point *D* also move upward. Hydraulic fluid is directed to the left end of servomotor cylinder *5*, moving piston *6* to the right, in the direction of opening the regulating member. As piston *6* moves, bell-crank lever *7* and links *8* and *9* return pivot *O* and valve spool *4* to the initial position. At the same time, as a result of opening the regulating member, the speed of the centrifugal governor increases and its sleeve *A* moves upward, returning the regulating member to its initial position. Thus, the steady-state condition of the turbine at constant load corresponds to a higher speed.

4247	REGULATOR MECHANISM WITH A TURBINE SPEED-CHANGING DEVICE	CHP Rg



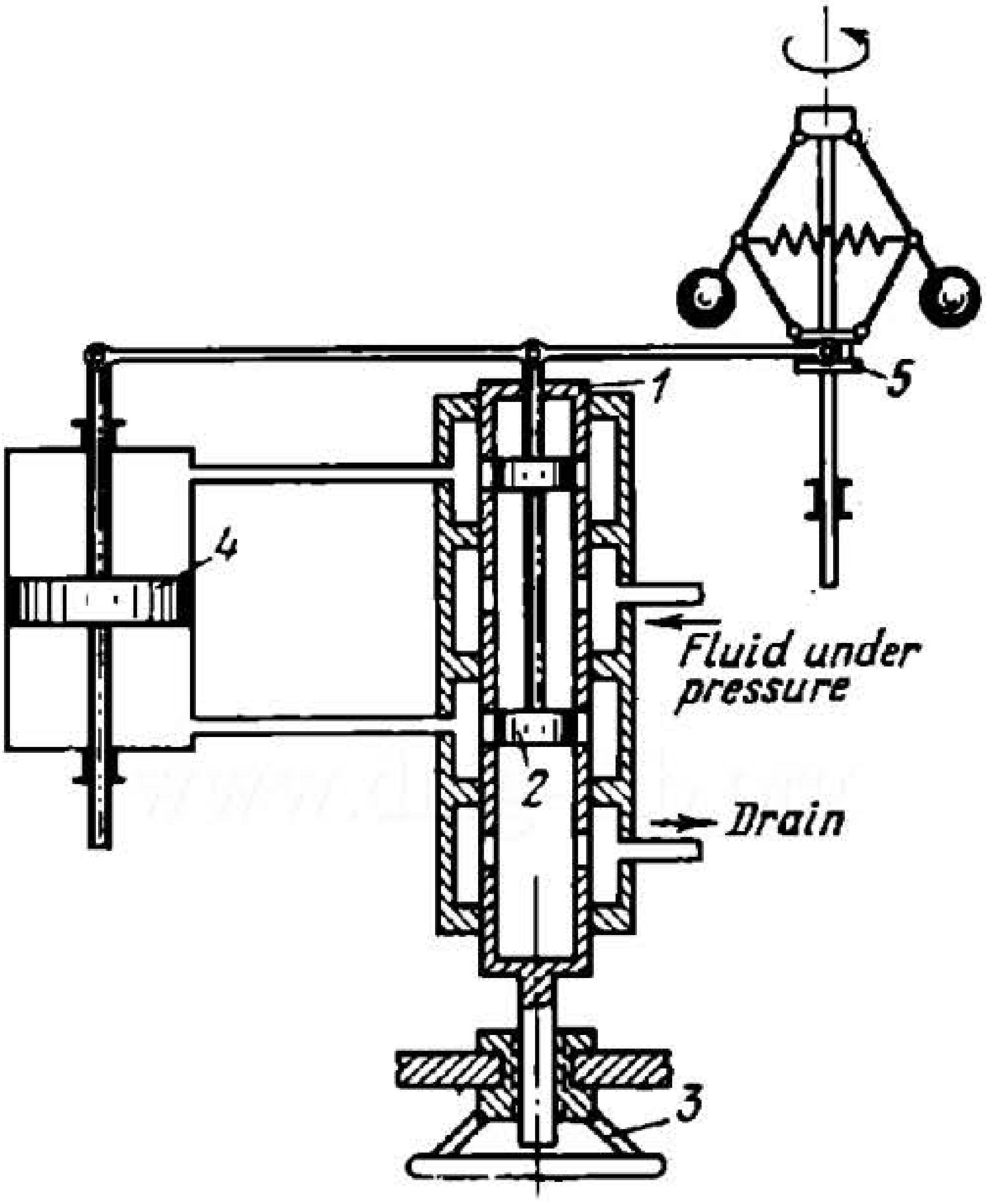
The turbine shaft speed maintained by the regulator can be changed by adjusting the tension of spring *1*, linked through lever *3* to sleeve *2* of the centrifugal governor. At a constant turbine load, if the tension of spring *1* is increased, sleeve *2* moves downward. At this, lever *3* turns about point *A*, shifting valve spool *5* upward. This directs hydraulic fluid so that piston *4* and valve member *6* move downward, increasing the supply of steam to the turbine. At constant load, the speed of the turbine shaft increases and sleeve *2* of the governor and, consequently, valve member *6* move upward, returning to the initial position. Thus the steady-state condition of the turbine at constant load corresponds to a higher speed. If the tension of spring *1* is reduced, the speed of the turbine shaft drops at constant load.

4248	REGULATOR MECHANISM WITH A TURBINE SPEED-CHANGING DEVICE	CHP Rg



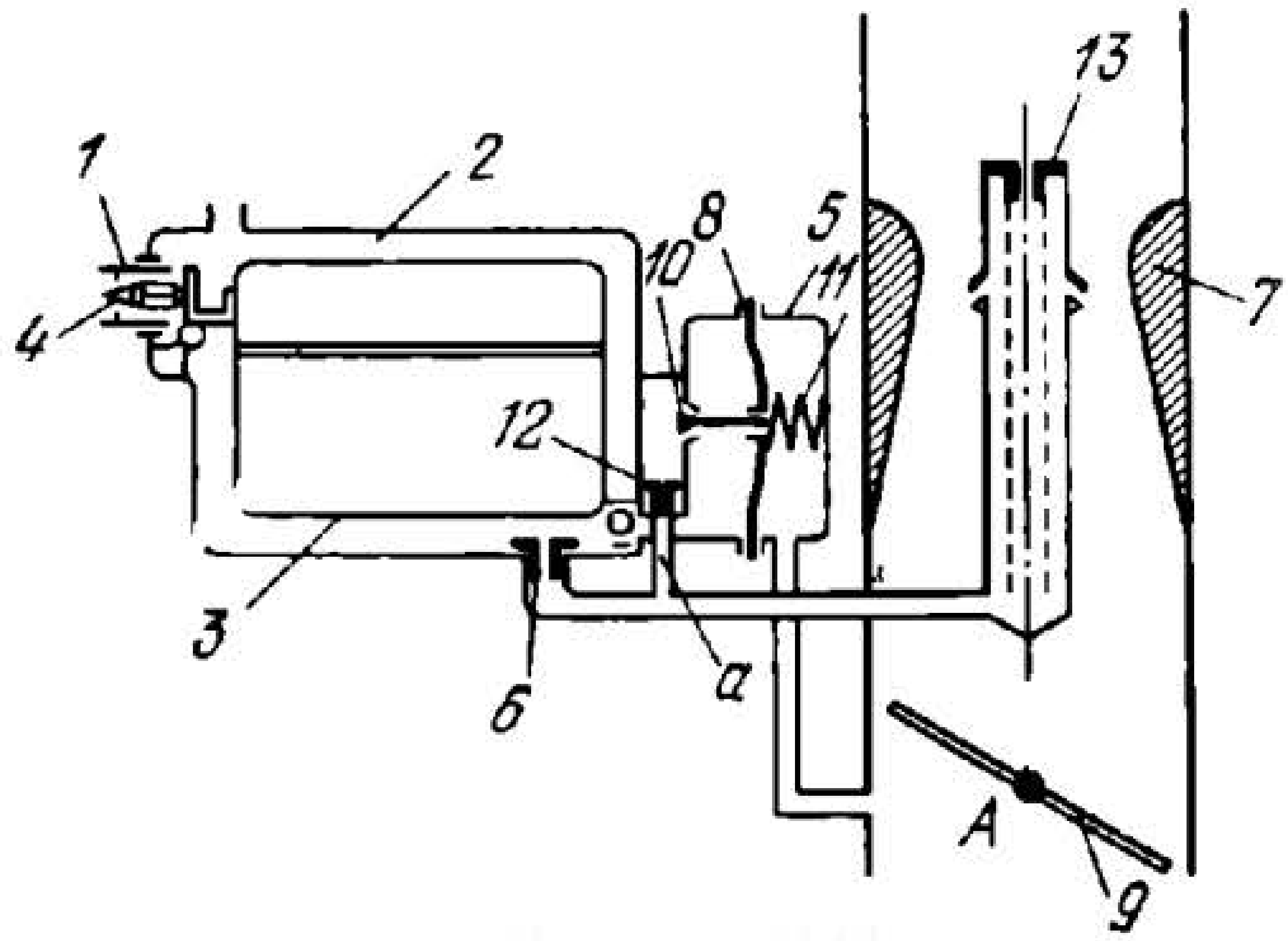
The turbine shaft speed is changed at constant load by adjusting the position of pivot *a* on piston rod *3* of servomotor *1*. This is done with nut *2* which can be moved along the thread of rod *3*. As point *d* is moved upward, valve spool *4* is also shifted upward, directing fluid to the upper end of servomotor *1* and moving valve member *5* downward to increase the supply of steam to the turbine. At constant load, valve member *5* should return to its previous position, and point *d*, for steady-state operation, always occupies the same position, which corresponds to blocked off ports in the directional valve. Therefore, when point *d* moves upward, sleeve *b* of governor *6* must move downward and this takes place only when the speed is reduced.

4249	REGULATOR MECHANISM WITH A TURBINE SPEED-CHANGING DEVICE	CHP Rg



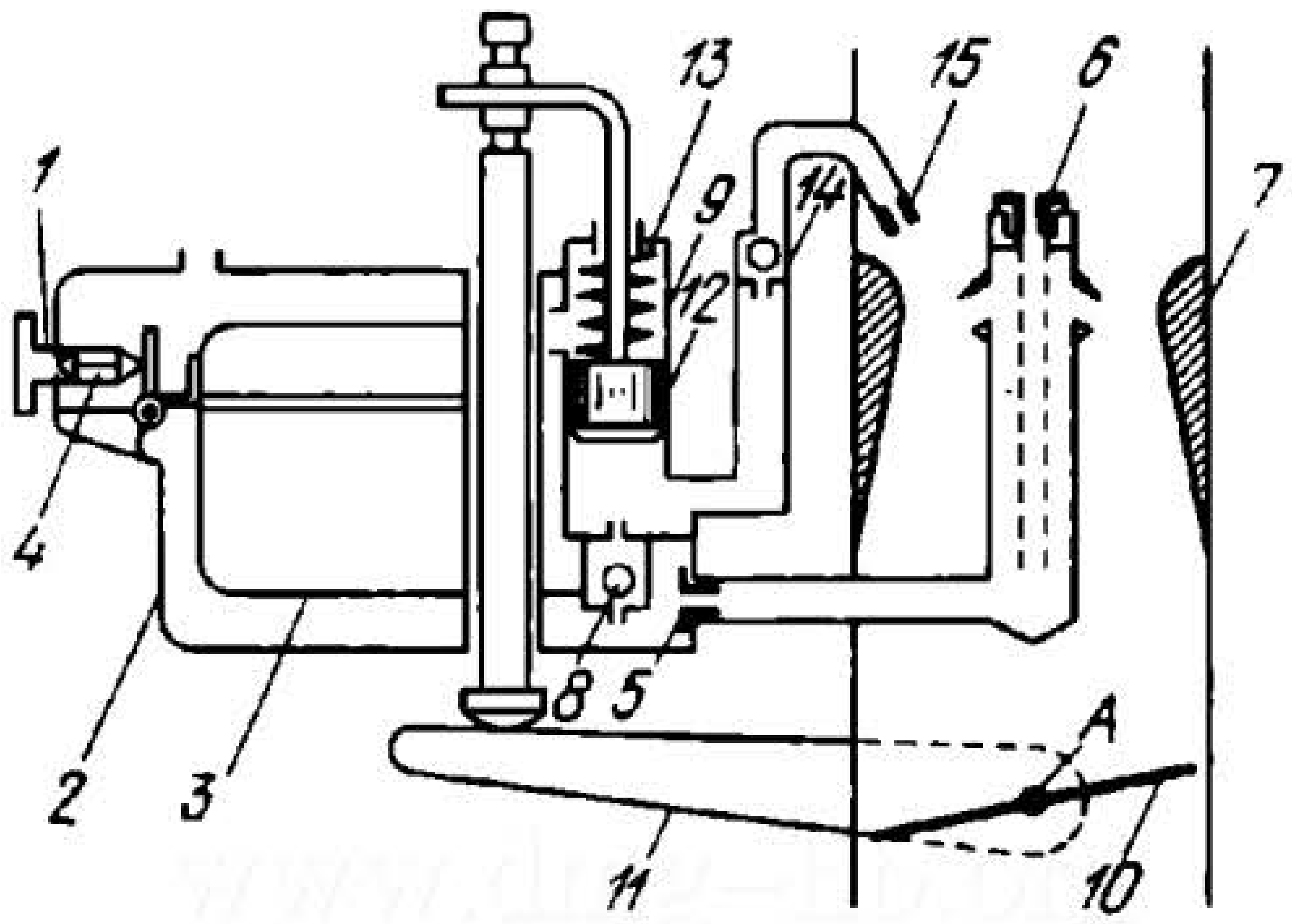
The turbine shaft speed can be changed at any load within a narrow limit by adjusting valve sleeve *1* with respect to valve spool *2*, using handwheel *3*. In this case, the position of valve spool *2*, corresponding to steady-state load on the turbine, for the same position of servomotor piston *4* (which corresponds to the opening of the regulating steam supply valve), must be changed to the new position of sleeve *1*. This changes the position of sleeve *5* of the centrifugal governor. Since movements of the governor sleeve are associated with changes in turbine speed, the same load can be carried at different speeds.

AUTOMOBILE CARBURETTOR MECHANISM WITH AN ECONOMIZER



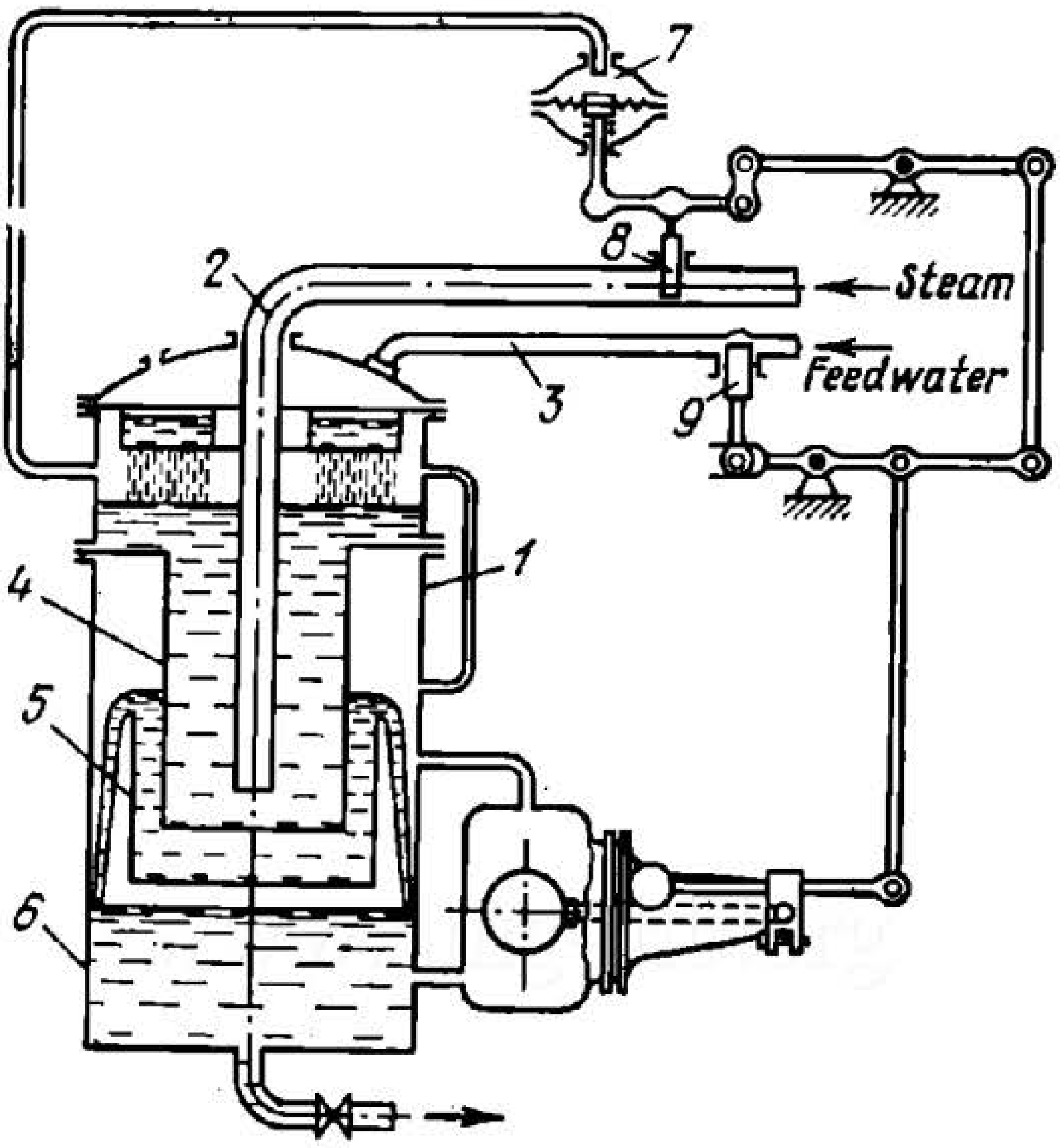
Fuel is admitted through pipe *1* to chamber *2* containing float *3*, which operates needle valve *4*. From the float chamber, fuel is delivered partly through channel *a* to economizer *5*, while the main part of the fuel passes through jet *6* into venturi *7* where it mixes with air under pressure admitted through jet *13*. The chamber of economizer *5* is divided into two compartments by diaphragm *8*. The compartment to the right of the diaphragm is connected to the space beyond throttle valve *9* which turns about fixed axis *A*. At medium engine loads, owing to vacuum in the right-hand compartment of the economizer, diaphragm *8* is bent to its extreme right position, closing valve *10*. In going over to full load of the engine, the vacuum to the right of the diaphragm is reduced to the extent that the diaphragm is bent by spring *11* to its extreme left position, opening valve *10*. At this, additional fuel is supplied to the venturi through jet *12* of the economizer.

4251 | **LEVER MECHANISM OF AN AUTOMOBILE CARBURETTOR WITH AN ACCELERATING PUMP** | CHP Rg



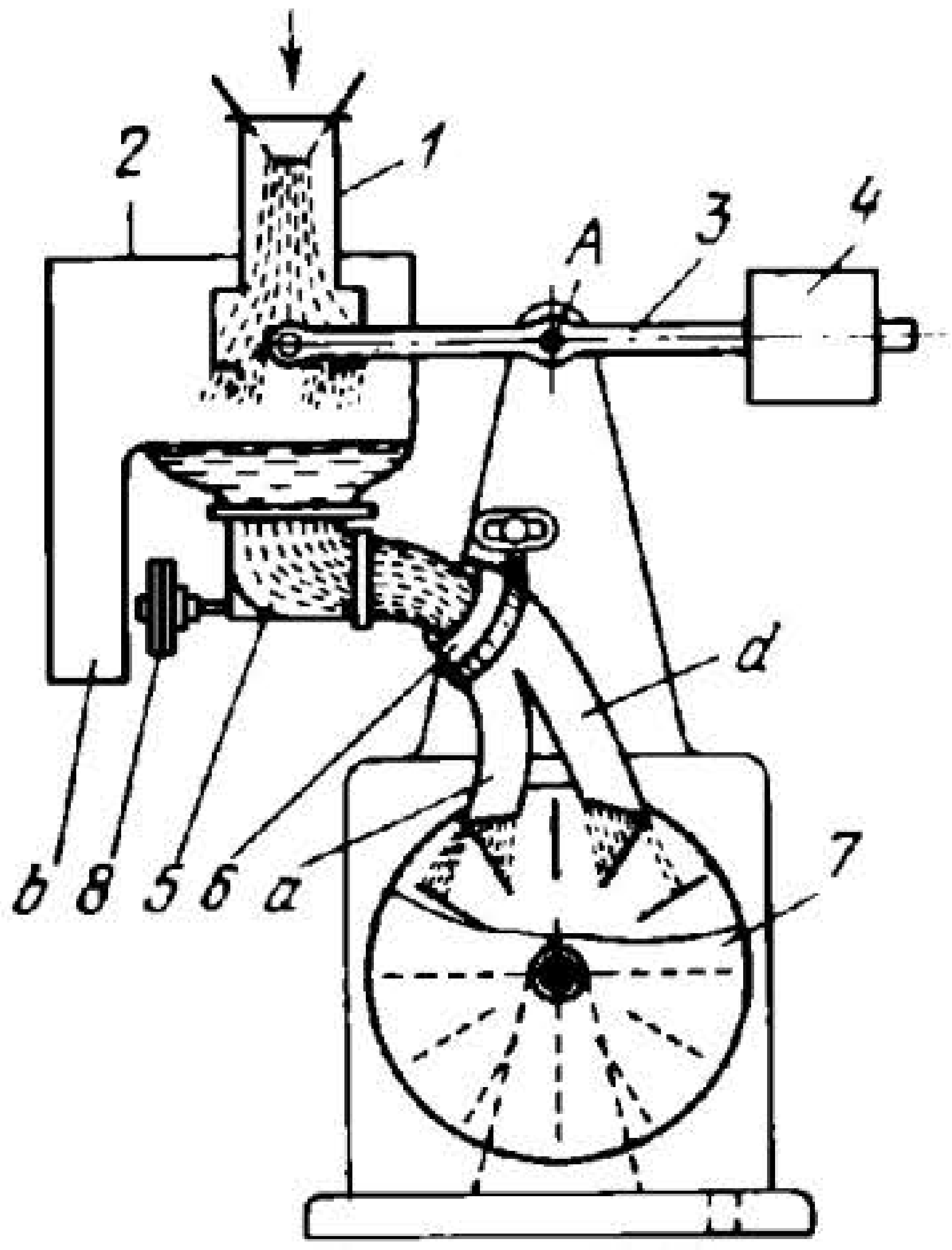
Fuel is admitted through pipe *1* to float chamber *2* containing float *3*, which operates needle valve *4*. From the float chamber, fuel is delivered through jet *5* into venturi *7* where it mixes with air under pressure admitted through jet *6*. A part of the fuel is delivered through ball valve *8* into chamber *9* of the accelerating pump. When throttle valve *10*, turning about fixed axis *A*, is opened, lever *11* turns downward. Piston *12* of the accelerating pump is also moved downward by spring *13*. At this, valve *8* is closed and fuel from the pump is delivered through ball valve *14* and jet *15* into venturi *7*. The accelerating pump is used to avoid leaning the fuel-air mixture when the throttle valve is opened.

4252	BOILER FEEDWATER DEAERATOR REGULATOR MECHANISM	CHP Rg



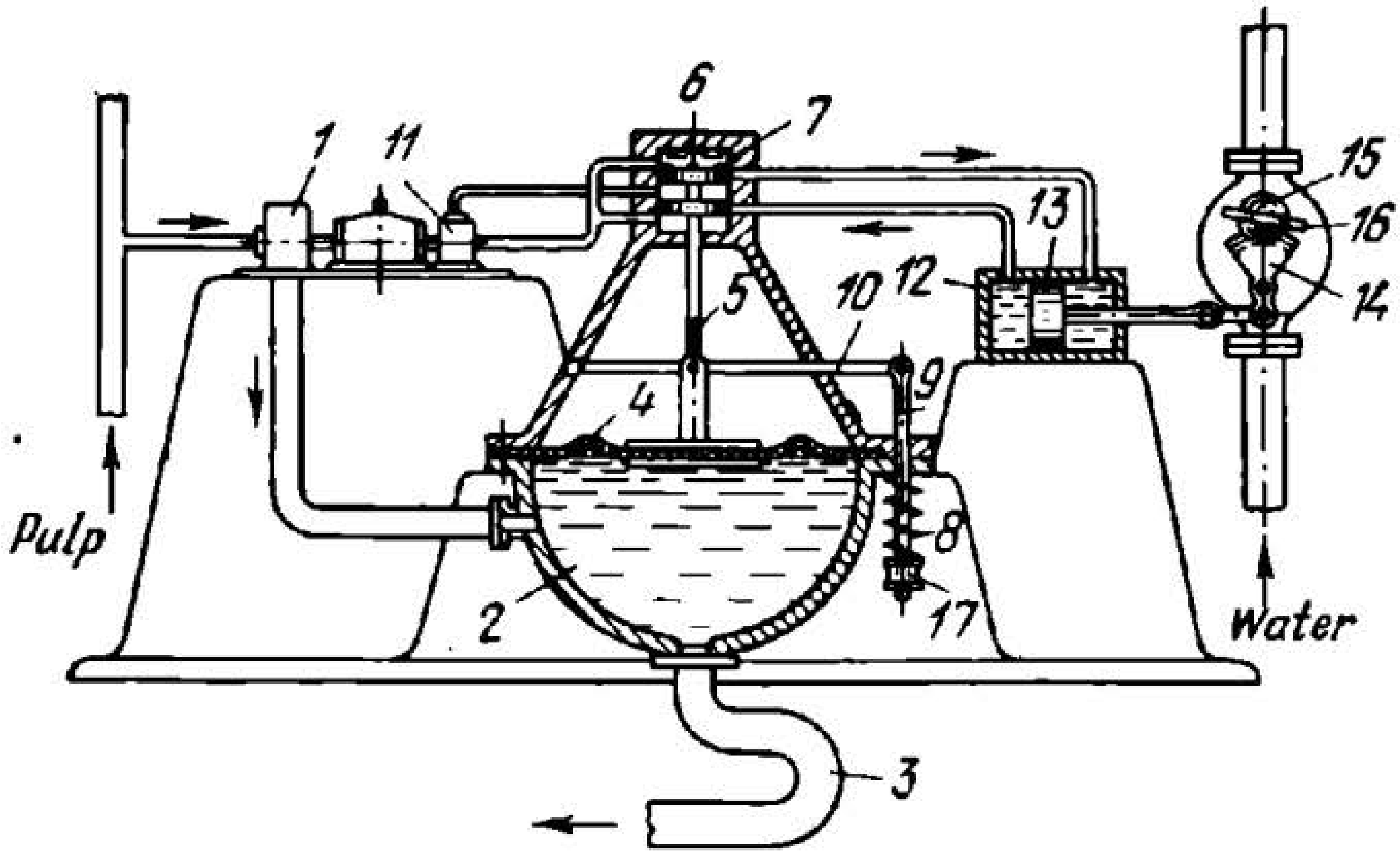
Feedwater, which is to be deaerated, is admitted into deaerator *1* through pipeline *3* and the heating steam, through pipeline *2*. The feedwater is heated and deaerated by bubbling with steam as it passes through the gap between the walls of pipeline *2* and cylinder *4*. Further, the water passes through the annular space between cylinder *4* and the wall of vessel *5*. Then the water flows over the edge of vessel *5* into deaerated water accumulator *6*. Air evolved from the feedwater in deaeration is discharged with a cert in amount of steam. Upon an increase in pressure in the deaerator, the membrane of pressure regulator *7* is bent downward, moving shutter *8* downward to reduce the amount of steam supplied to the deaerator. Through a system of levers, shutter *9* is also moved downward, increasing the amount of feedwater admitted for deaeration. Upon a drop in pressure in the deaerator, the elements of the regulator operate in the reverse direction. The feedwater level in the deaerator is controlled in a similar manner.

4253	PAPER PULP CONSISTENCY REGULATOR MECHANISM	CHP Rg



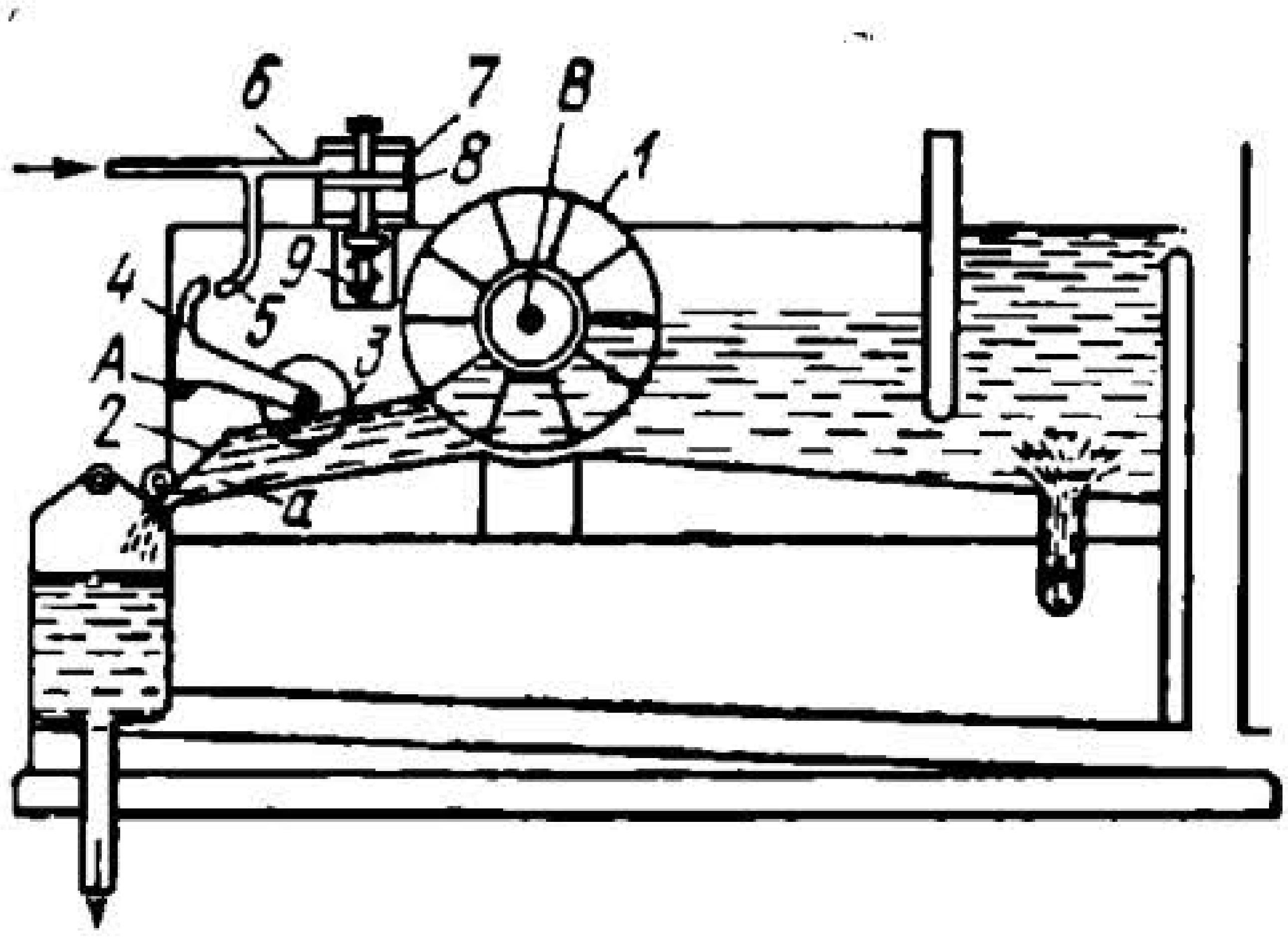
The paper pulp is admitted through pipe *1* at a constant head into suspended vessel *2*, which is linked by a hinged joint to two-arm lever *3*. Lever *3* turns about fixed axis *A* and has counterbalancing weight *4*, which can be adjusted along the lever. Surplus pulp is discharged through overflow pipe *b*. From vessel *2*, the pulp passes through nozzle *5*. Since the rate of flow through the nozzle depends upon the degree of thickness of the pulp, variations in the consistency of the pulp change its level in vessel *2*. Nozzle *5* fits into V-shaped pipe *6* with two branches, *a* and *d*. Depending upon its consistency, the pulp passes through branche *a* or *d*, or simultaneously through both. When the pulp is of the required consistency, it passes through both simultaneously. Weight *4* is adjusted along lever *3* to correspond to this consistency. By changing the position of weight *4*, the degree of consistency of the pulp can be varied, setting the pipe branches in the central position. At increased consistency, the pulp passes mainly through branch *a* and, dropping on the vanes of rotor *7*, turns it counterclockwise. The rotor operates a water regulating valve (not shown), increasing the amount of water supplied to the pulp. The setting of vessel *2* with respect to the rotor can be adjusted by means of counterweight *8*. Upon reduced consistency, the pulp passes through branch *d* and turns rotor *7* clockwise. This reduces the water supply and raises the consistency of the pulp.

4254	TYAGUNOV PAPER PULP CONSISTENCY REGULATOR MECHANISM	CHP Rg



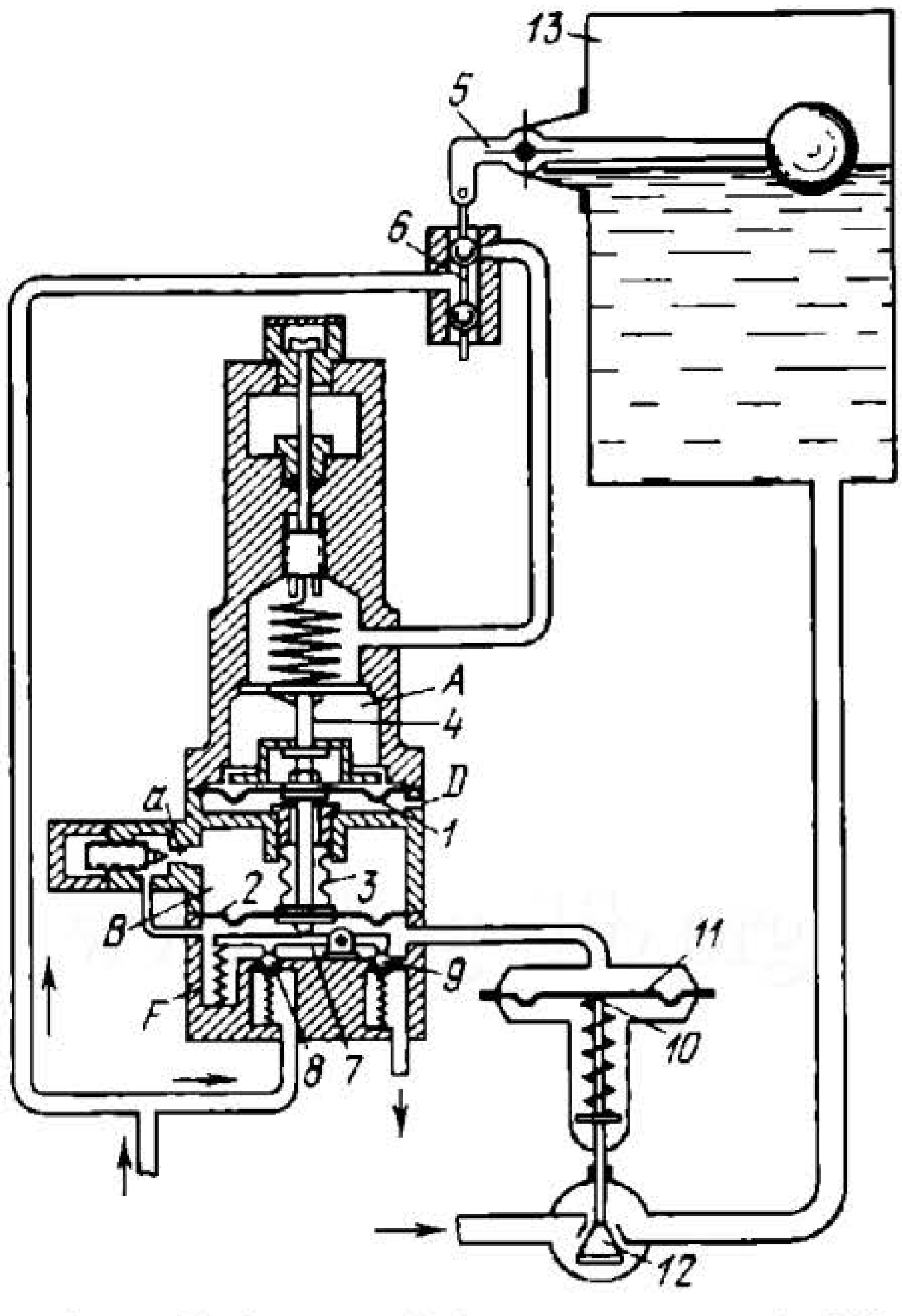
A small amount of paper pulp is delivered by pump *1* into vessel *2* from which it flows out through friction pipe *3*. Secured in vessel *2* is membrane *4*, which is linked by stem *5* to spool *6* of directional valve *7*. Spring *8* with levers *9* and *10* serve to vary the elastic characteristic of the membrane. The electric motor that drives pump *1* also drives gear pump *11*, which delivers hydraulic fluid to valve *7*. Fluid from the valve is directed to servomotor cylinder *12* with piston *13*, whose rod is linked through segment gear *14* and gear *15* to gate valve *16* of the water supply. If the consistency of the pulp increases, its friction in passing through friction pipe *3* also increases and its rate of flow is reduced. This increases the pressure in vessel *2*, membrane *4* is bent upward, shifting valve spool *6* upward so that fluid is delivered to the right end of cylinder *12*, moving piston *13* to the left. This opens gate valve *16*, increasing the amount of water supplied to the pulp. Upon a decrease in consistency, the elements of the regulator operate in the reverse direction. The regulator can be adjusted to a definite pulp consistency by two ways: coarse adjustment by turning the handle of gate valve *16* with respect to gear *15*, and fine adjustment by changing the compression of gauged spring *8* by adjusting nut *17*.

4255	PAPER PULP CONSISTENCY AND QUANTITY REGULATOR MECHANISM	CHP Rg



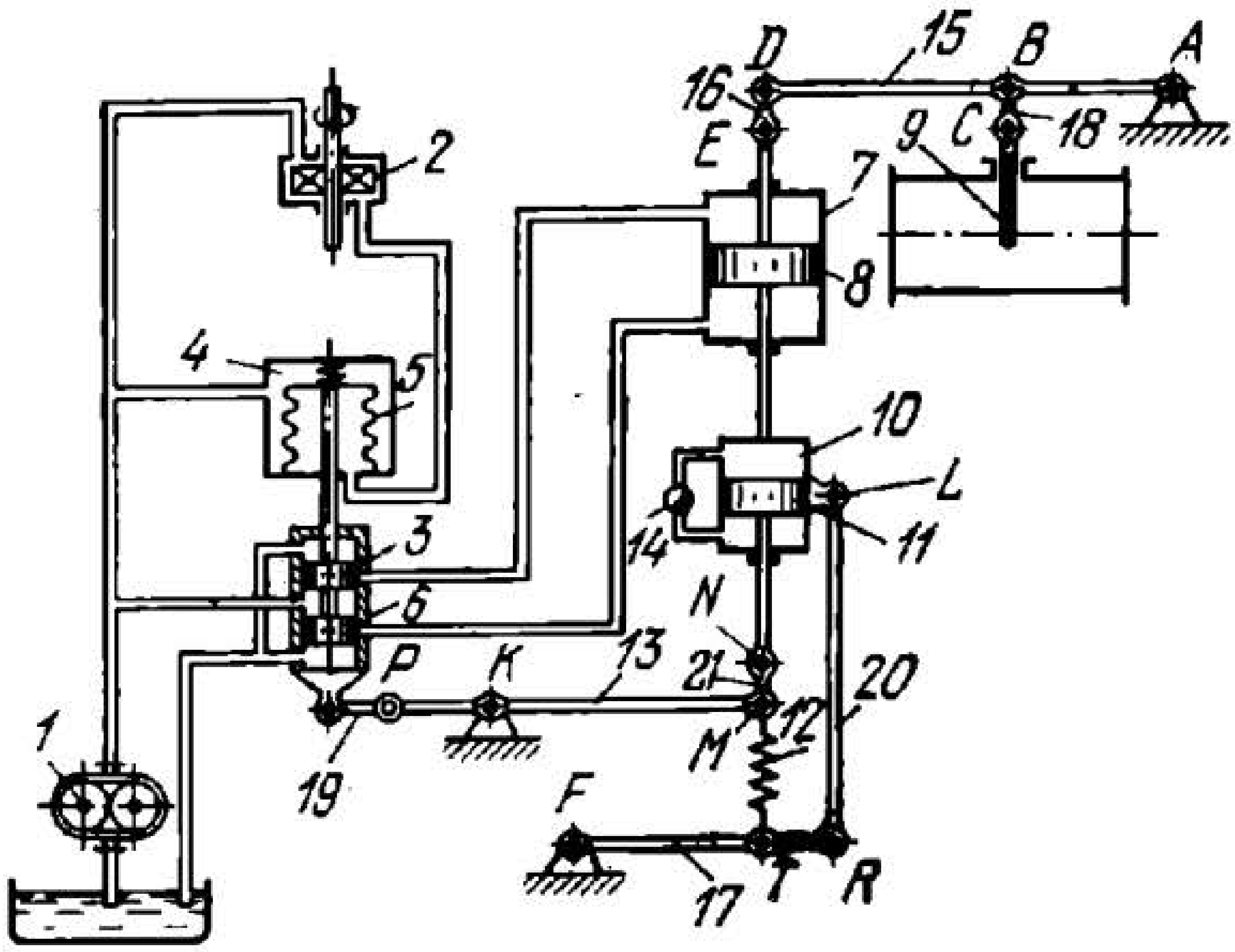
The paper pulp is delivered by a pump to the intake bath of the regulator in which a constant pulp level is maintained. Drum *1* rotates at constant speed about fixed axis *B* and is divided into equal sections. Therefore, the pulp always passes out from under the drum in equal volumes in equal time intervals. The outflow of the pulp is regulated by backing wall *2* which is set to correspond to the required pulp consistency. Upon a change in consistency, the rate of flow through slit *a* changes and, therefore, its level between the drum and wall *2* also changes. Upon an increase in consistency of the pulp, the level is raised. This raises float *3*, turning lever *4* about fixed axis *A*. The end of the lever is withdrawn from pipeline *5* and the pressure in pipeline *6*, through which compressed air is delivered, and in cylinder 7 drops. At this, the rod of piston *8* is raised by spring *9* and, by means of a device (not shown), increases the water supply. Upon a decrease in the pulp consistency, the elements of the regulator operate in the reverse direction.

4256	PNEUMATIC LIQUID-LEVEL REGULATOR MECHANISM	CHP Rg



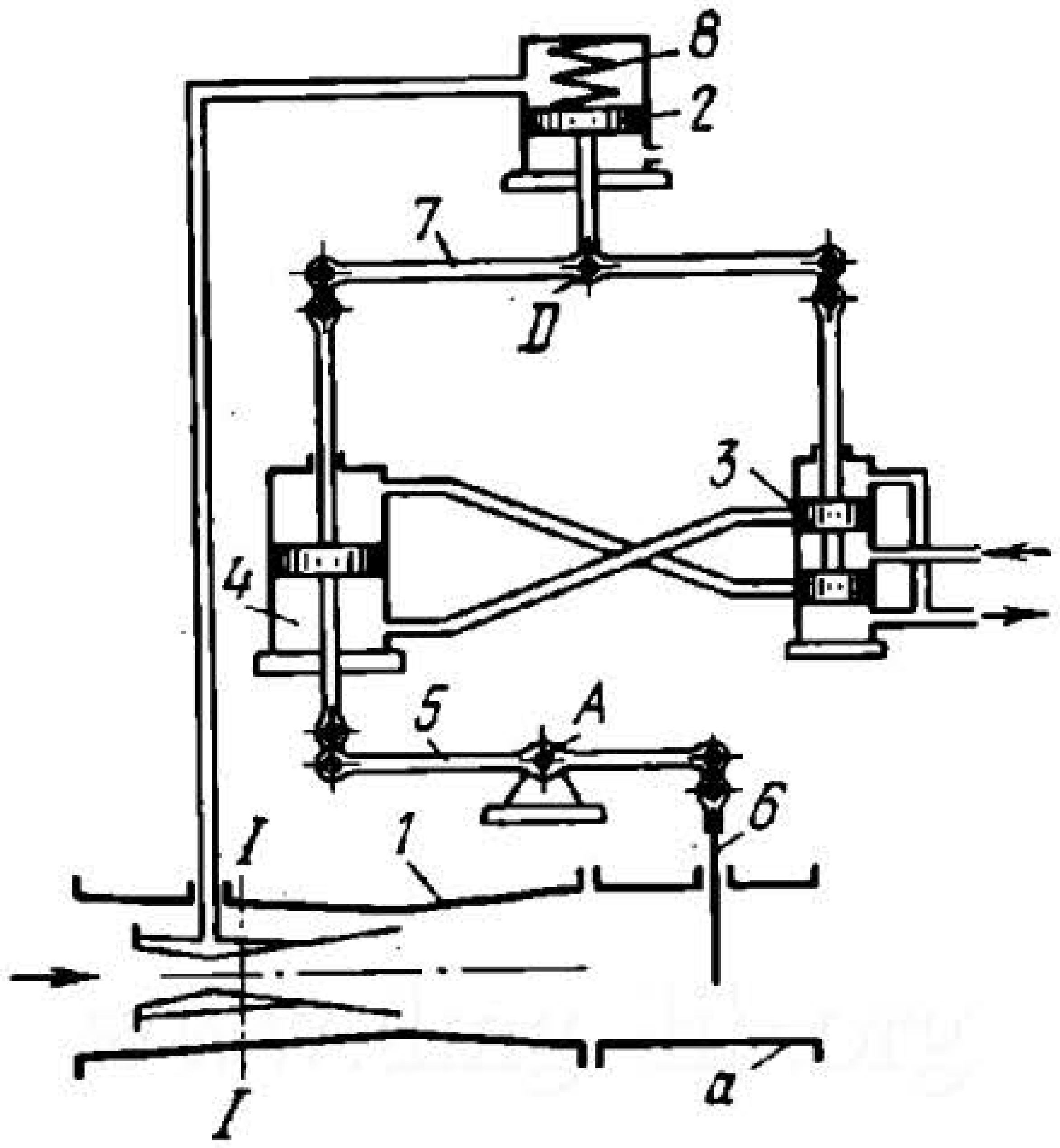
Chambers A and D of the regulator are separated by membrane *1*, chambers B and F, by membrane *2* and chambers D and B, by bellows *3*. The membranes and bellows are linked to rod *4*. Chamber D is connected to the atmosphere, and chambers B and F are connected together through throttling aperture a. When the level of the liquid in vessel *13* drops, bell-crank lever *5* turns clockwise and shifts valve member *6* upward. Compressed air, delivered to the valve, is admitted into chamber A. This bends membrane *1* downward together with rod *4*. The rod turns rocker arm *7* which opens valve *8* to admit compressed air. Valve *9* remains closed. The pressure in chamber F increases and is transmitted to servomotor *10* where it bends membrane *11* downward. This opens valve member *12*, increasing the supply of liquid to vessel *13*. As a result of the gradual flow of air from chamber F to chamber B, rod *4* is displaced a certain distance more, until the pressure in chamber A becomes equal to the initial pressure.

4257	SPEED REGULATOR MECHANISM	CHP Rg



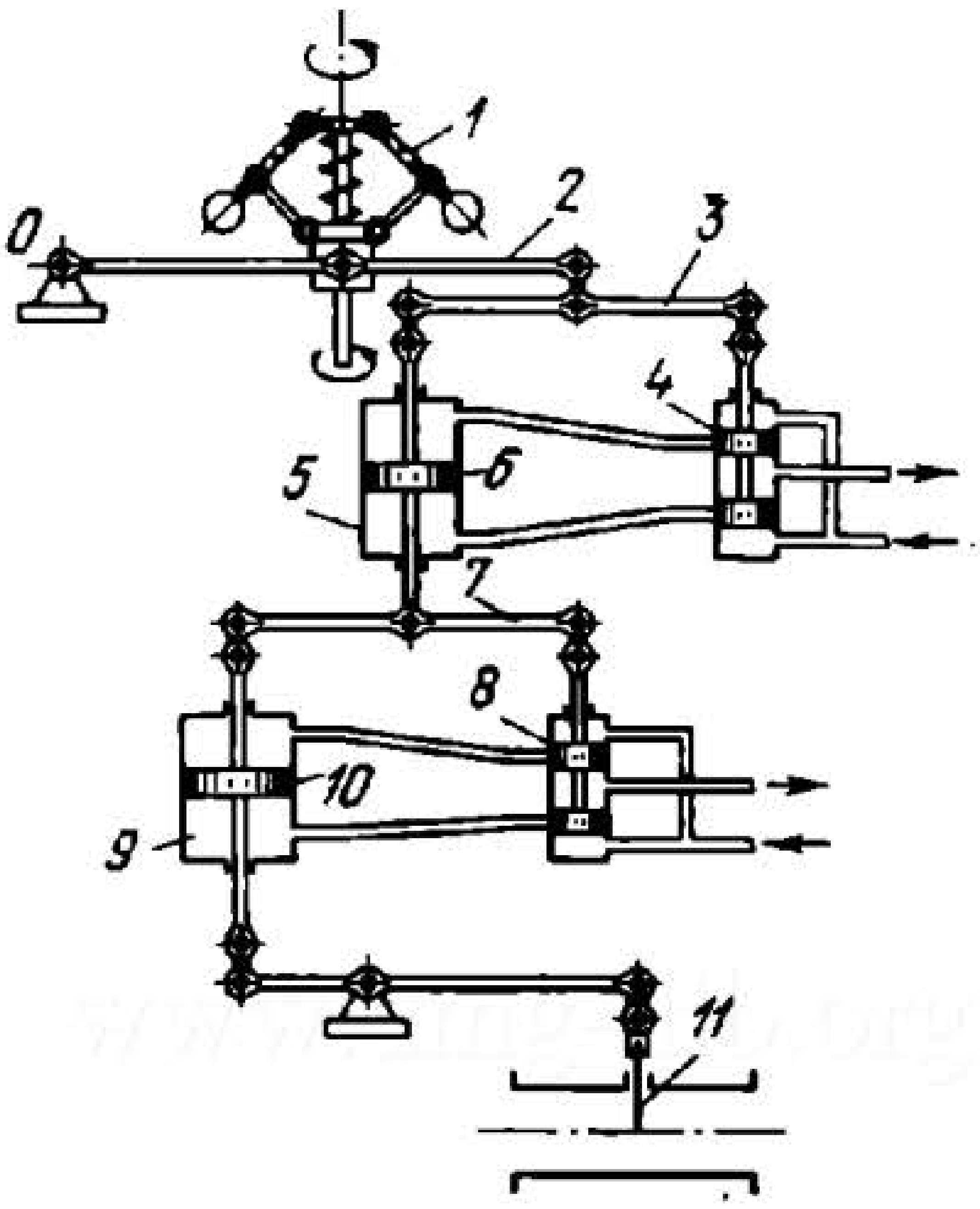
Lever *15* turns about fixed axis *A* and is connected by turning pairs *B* and *D* to links *18* and *16*, which are connected by turning pairs *C* and *E* to gate valve member *9* and to the rod of piston *8*. Lever *17* turns about fixed axis *F* and is connected by turning pair *R* to link *20* which, in turn, is connected by turning pair *L* to the cylinder of cataract *10*. Lever *13* turns about fixed axis *K* and is connected by turning pairs *M* and *P* to links *21* and *19*. Link *21* is connected by turning pair *N* to the rod of cataract piston *11*, and link *19* by a turning pair to the body of valve *6*. Spring *12* is connected at points *M* and *T* to levers *13* and *17*. Gear pump *1* delivers fluid under pressure to centrifugal pump *2* which is linked to the shaft whose speed is to be regulated. The pipeline to pump *2* is also connected to valve *6* and to chamber *4* of bellows *5*. Upon an increase in speed of the shaft being regulated, the impeller of pump *2* rotates faster and increases the pressure of the fluid inside bellows *5*, which stretches, raising valve spool *3*. At this, fluid from the valve is directed to the upper end of servomotor *7*, moving piston *8* downward. This lowers valve member *9*, reducing the amount of heat-carrying agent supplied to the system. Moved downward together with piston *8* are the cylinder of cataract *10* and, due to the pressure of the fluid in it, piston *11*, compressing spring *12*. At this, lever *13* raises the body of valve *6* so that its ports are blocked off by spool *3*, stopping the fluid delivery to servomotor *7*. Then, compressed spring *12* moves piston *11* slowly upward, the fluid from the upper end being throttled as it passes through flow-control valve *14* to the lower end of the cataract. This lowers the body of valve *6* again and an additional amount of fluid is delivered to servomotor *7*, lowering valve member *9* somewhat more. This regulating process continues until the elements of the regulator return to the initial position. Upon a decrease in speed of the shaft being regulated, the elements of the regulator operate in the reverse direction.

4258	GAS FLOW RATE REGULATOR MECHANISM	CHP Rg



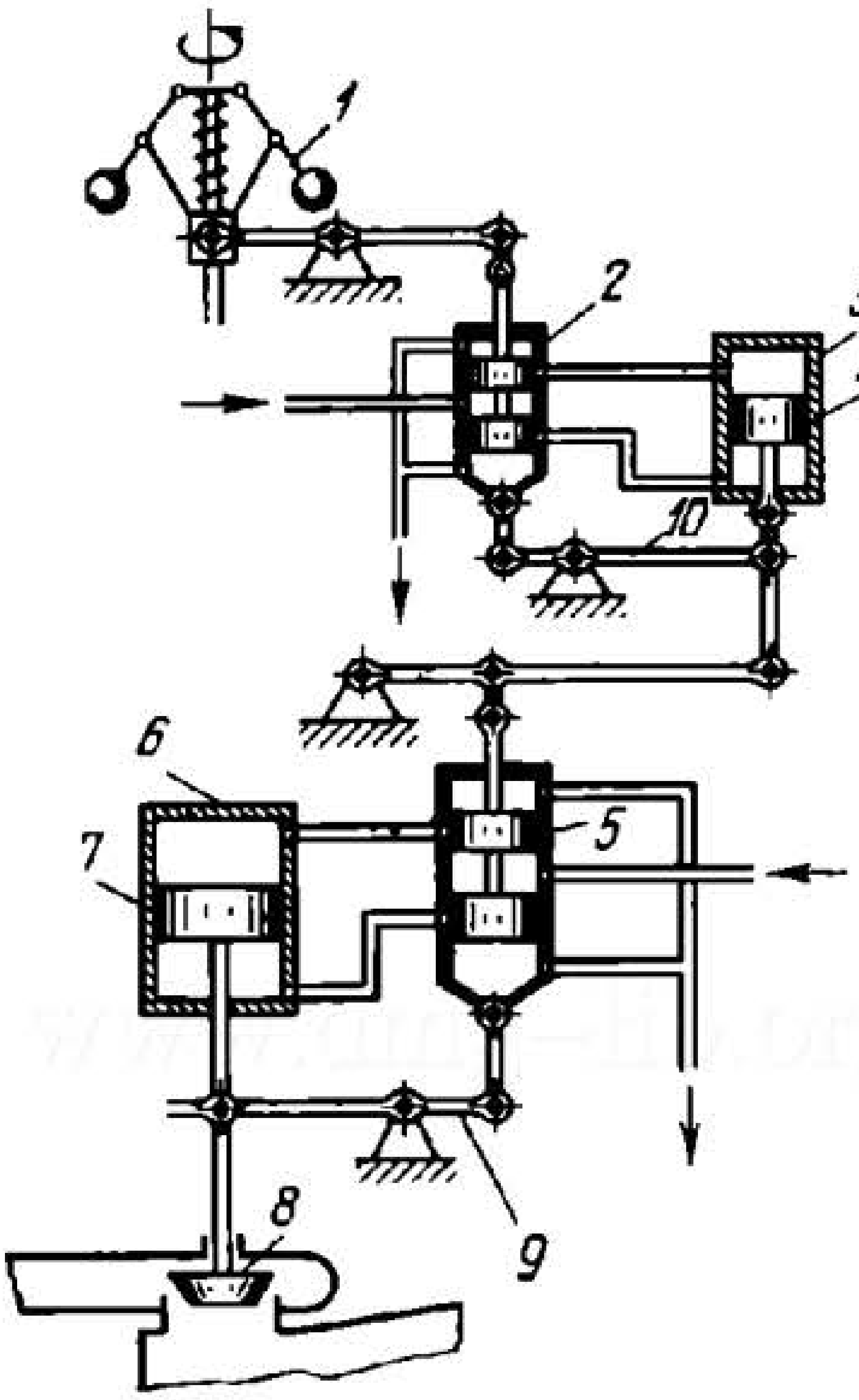
Upon an increase in the amount of air drawn in through pipe *a*, its velocity also increases as, consequently, does the degree of vacuum at cross section *I-I* of venturi *1* and in the upper end of cylinder *8*. Atmospheric pressure moves piston *2* upward, shifting valve spool *3* in the same direction. Hydraulic fluid from the valve is delivered to the lower end of servomotor *4*, moving its piston upward. This turns lever *5* about fixed axis *A* and lowers shutter *6*, reducing the amount of air drawn in. As shutter *6* is moving downward, lever *7* turns about axis *D* and shifts valve spool *3* downward, stopping fluid delivery to the servomotor. Upon a decrease in the amount of air drawn in through pipe *a*, the pressure at cross section *I-I* increases, piston *2* is moved downward by spring *8* and the elements of the regulator operate in the reverse direction.

4259	REGULATOR MECHANISM WITH CASCADE AMPLIFICATION	CHP Rg



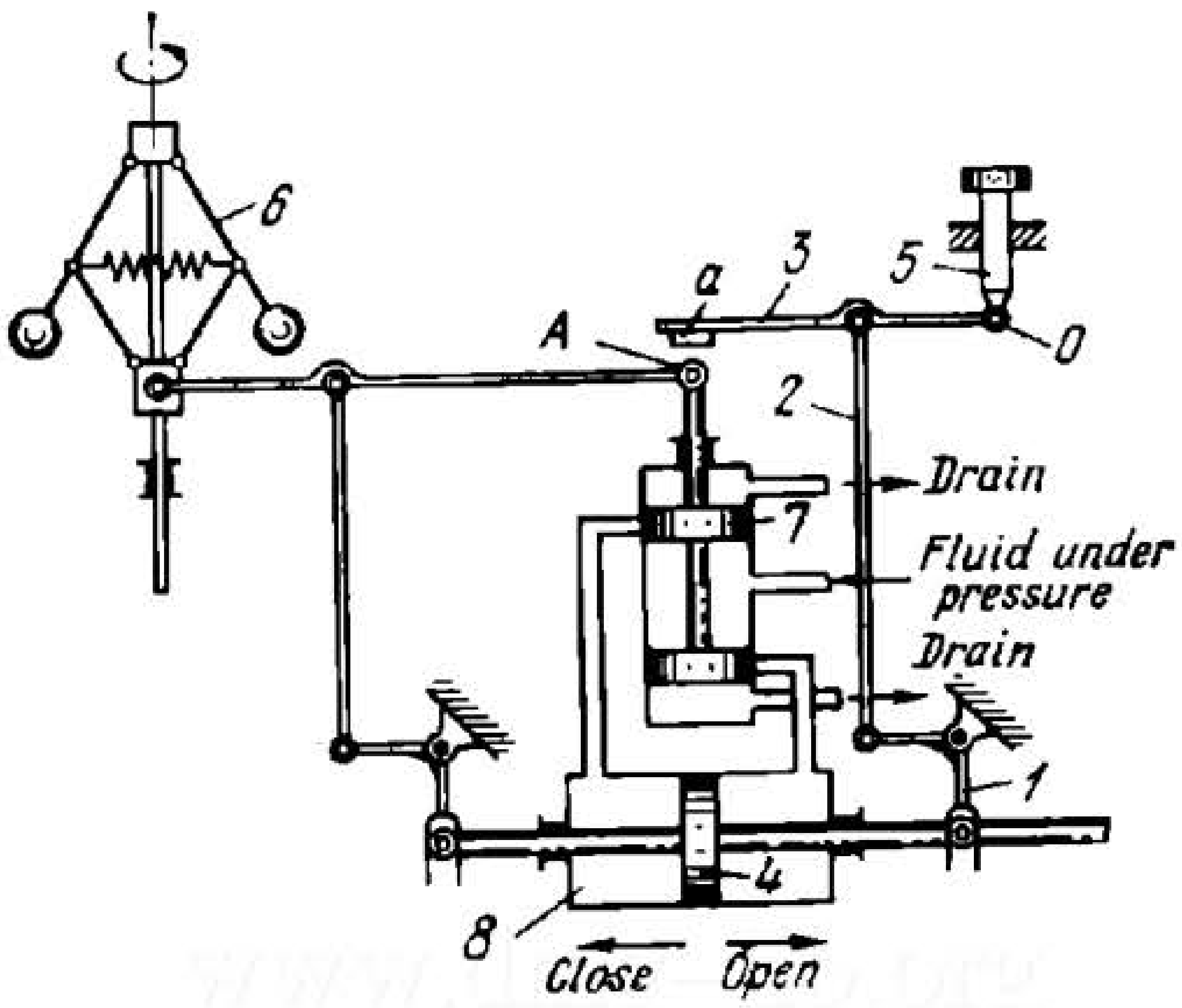
Upon a change in speed of the shaft being regulated, the sleeve of centrifugal governor *1* moves up or down, turning lever *2* about fixed axis *O*. At this, lever *3* shifts valve spool *4* and fluid from the valve is delivered to one end of servomotor *5*, moving piston *6* up or down. Through lever *7*, this shifts valve spool *8* and fluid from the valve is delivered to one end of servomotor *9*, moving piston *10* up or down. This closes or opens regulating gate valve member *11*. Feedback levers *3* and *7* return valve spools *4* and *8* to their central position. The consecutive operation of two cascades (valve-servomotor sets) provides an actuating force sufficient to operate heavy regulating members.

4260	REGULATOR MECHANISM WITH TWO SERVOMOTORS IN SERIES	CHP Rg



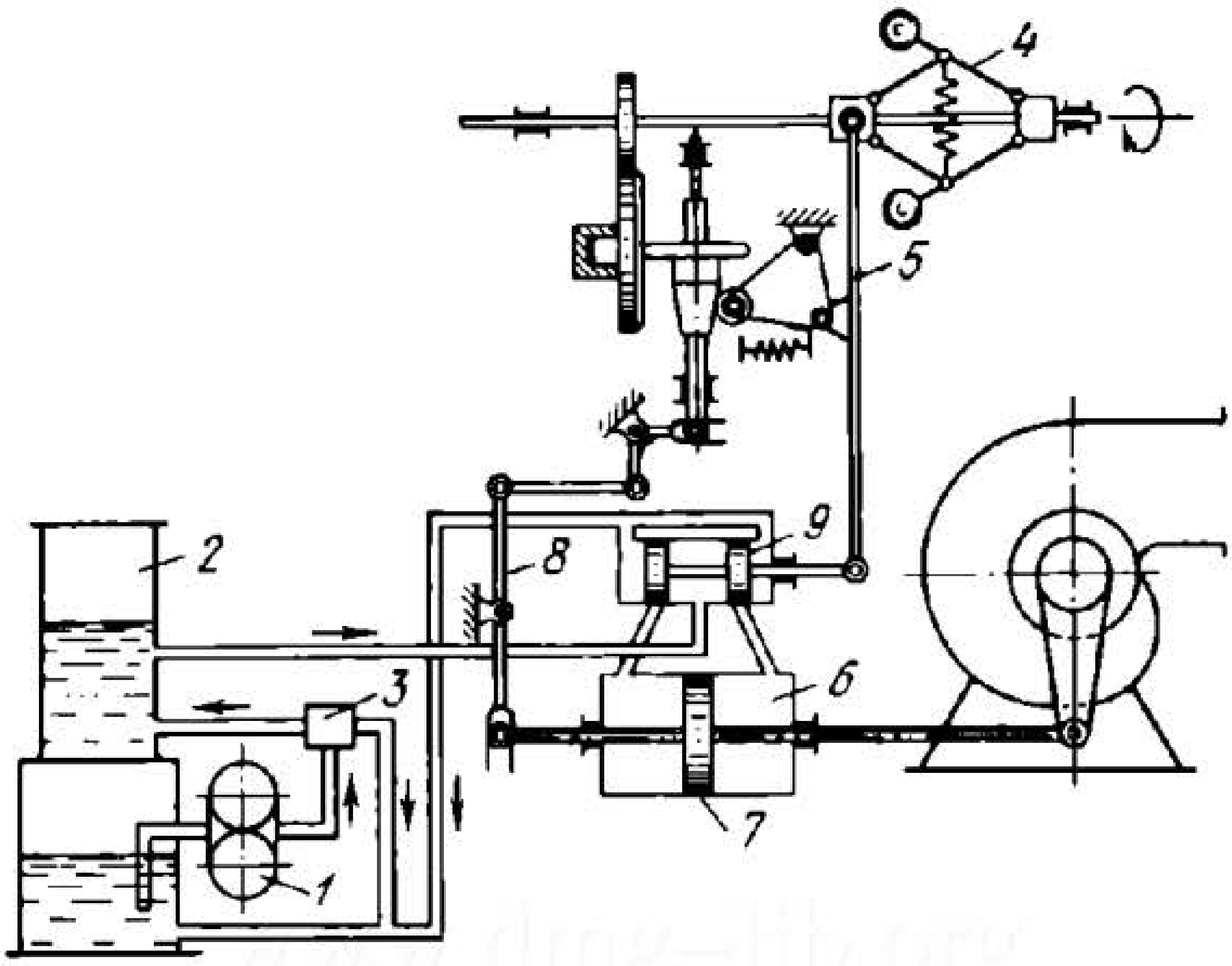
Upon a change in speed of the shaft being regulated, the sleeve of centrifugal governor *1* moves up or down, shifting valve spool *2*. Fluid from the valve is delivered to one end of servomotor *3*, moving piston *4* up or down. This shifts valve spool *5* and fluid from the valve is delivered to one end of servomotor *6*, moving piston *7* up or down. Piston *7* controls valve member *8*, which regulates the amount of steam supplied to the turbine. The use of two servomotors increases the actuating force that operates the regulating member. Feedback levers *9* and *10* shift the housings of the valves, returning them to the neutral position.

4261	REGULATOR MECHANISM WITH A DEVICE FOR LIMITING THE AMOUNT THE REGULATING MEMBER IS OPENED	CHP Rg



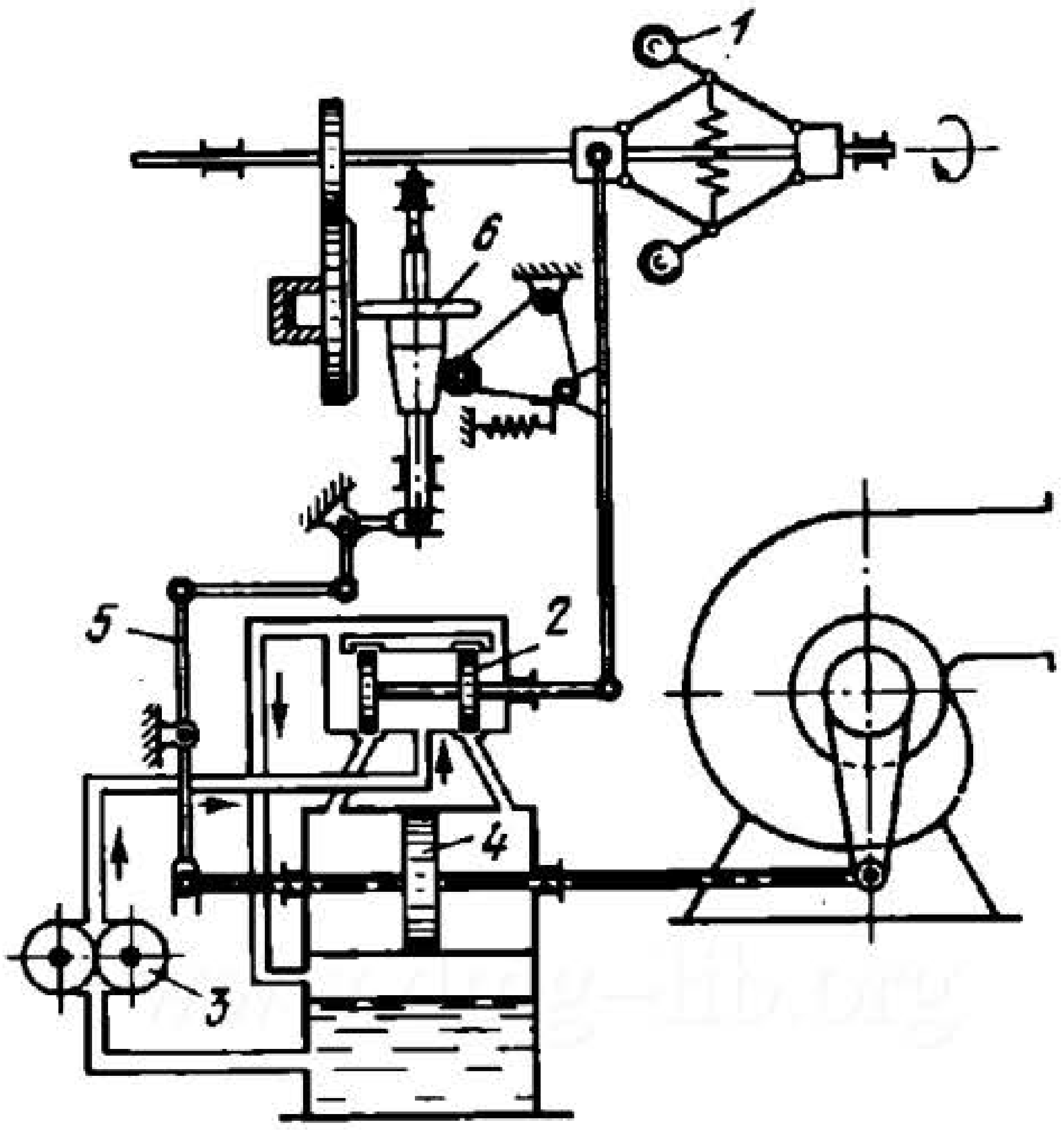
To limit the amount the regulating member is opened, the regulator system is supplemented with four-bar linkage *1*, *2* and *3*, which is linked to the rod of piston *4* and is supported by screw *5*. Using screw *5*, the stroke of the servomotor piston can be limited to any amount of opening the regulating member. When the speed of centrifugal governor *6* is reduced, valve spool *7* is shifted upward. Fluid from the valve is delivered to the left end of servomotor *8*, moving piston *4* to the right, in the direction of opening the regulating member. Lever *3* is turned about point *O*, and its tip *a* can contact point *A* of the valve spool stem. This limits the amount valve spool *7* can be shifted upward, in the direction in which piston *4* is moved to the right to open the regulating member.

BOILER-TYPE REGULATOR MECHANISM



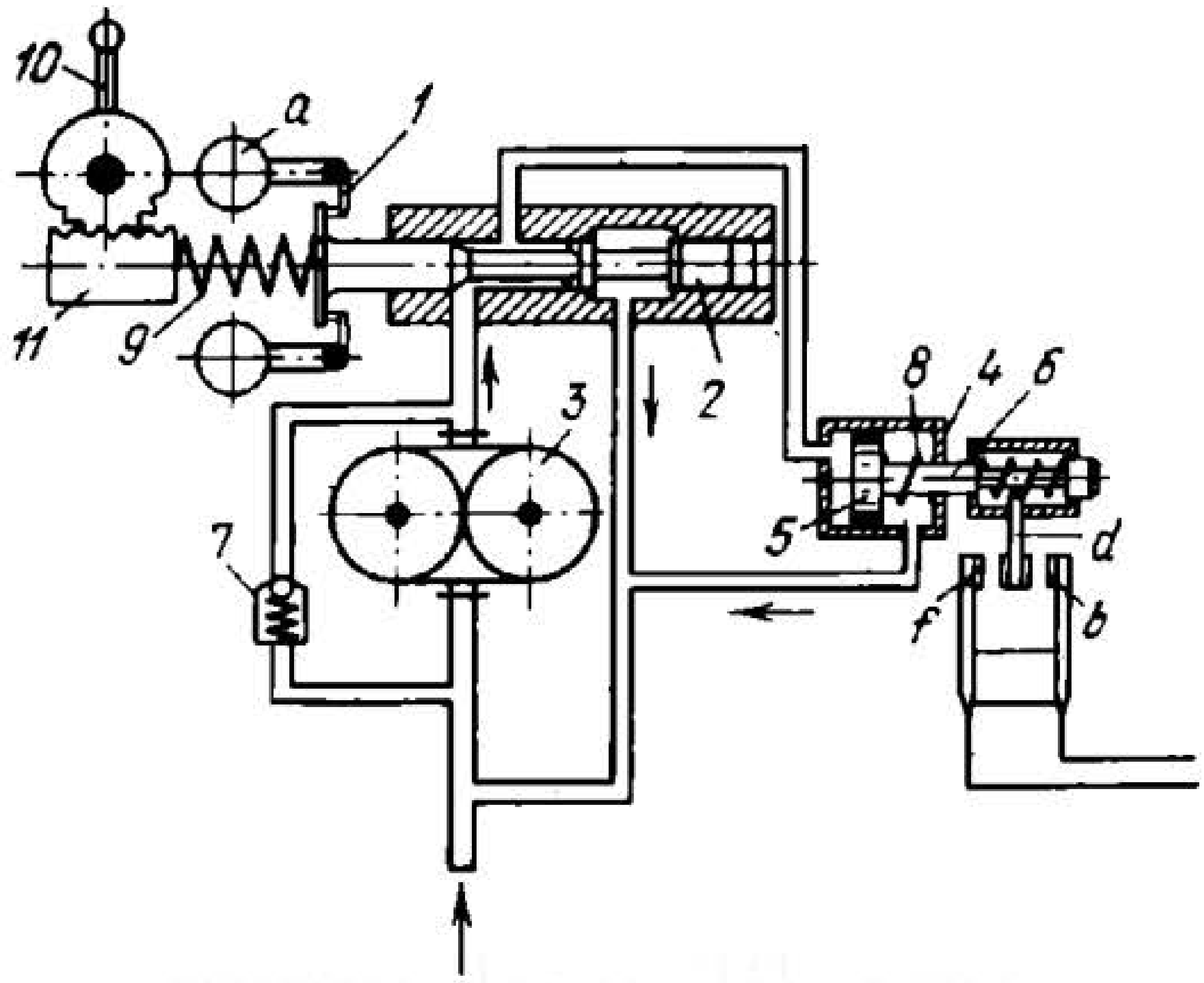
Pump *1* delivers hydraulic fluid to boiler *2* which is filled partly with fluid and partly with air, and serves as an accumulator. Upon normal pressure in the boiler, by-pass valve *3* directs fluid from the boiler back to the tank. When the pressure drops in the boiler, valve *3* closes and fluid is delivered by the pump into boiler *2*. Fluid from the boiler is directed to the valve of spool *9*, which has positive overlapping. The width of the lands on the spool is somewhat greater than the width of the valve ports. In the central position of spool *9* its lands block off the ports in the valve body and no fluid flows in from the boiler. Upon a change in speed, the sleeve of centrifugal governor *4* moves to the right or left, shifting valve spool *9* by means of lever *5*. Fluid delivered to the valve is directed to servomotor *6*, moving piston *7* and turning the regulating member. As piston *7* moves, lever *8* puts the frictional transient feedback mechanism into operation.

4263	FLOW-TYPE REGULATOR MECHANISM	CHP Rg

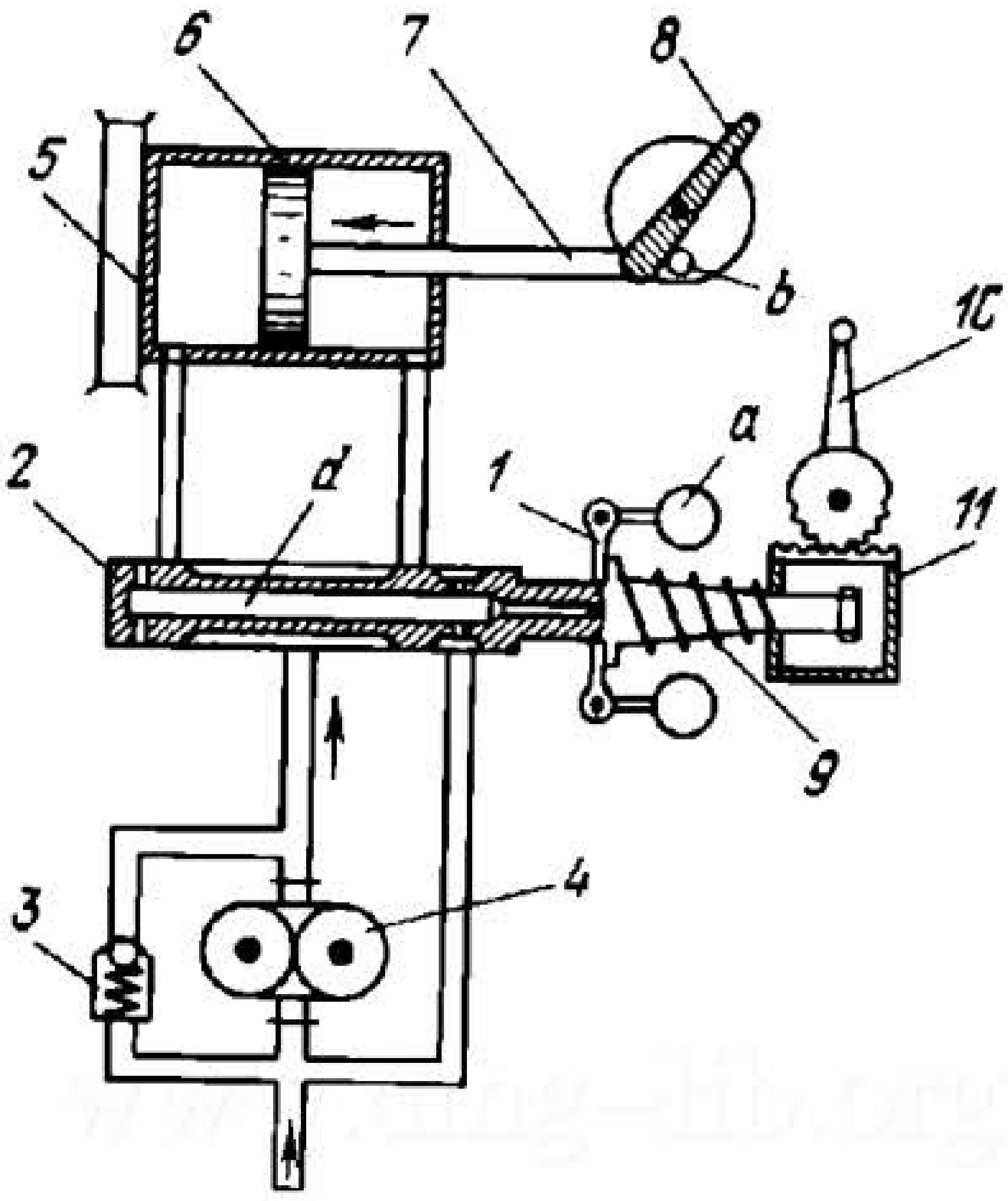


Upon an increase in speed of the shaft being regulated, the sleeve of centrifugal governor *1* moves to the right, shifting valve spool *2* to the left. Hydraulic fluid is delivered to the valve by continuously rotating gear pump *3*. The valve has negative overlap, since the width of the spool lands is somewhat less than the width of the ports in the valve body. In the central position of the spool, fluid flows past the lands and is drained to the tank. When the spool is shifted to the left, the clearance at the right edge of the left land increases and that at the left edge of the right land decreases. The fluid is admitted through the left land clearance into the left end of the servomotor; fluid from the right end is discharged to the tank. Piston *4* moves to the right, actuating the regulating member so that the shaft speed is reduced. This also turns lever *5* to put the frictional transient feedback mechanism *6* into operation. Upon a reduction in shaft speed, the elements of the regulator operate in the reverse direction.

4264	PROPELLER SPEED REGULATOR MECHANISM	CHP Rg

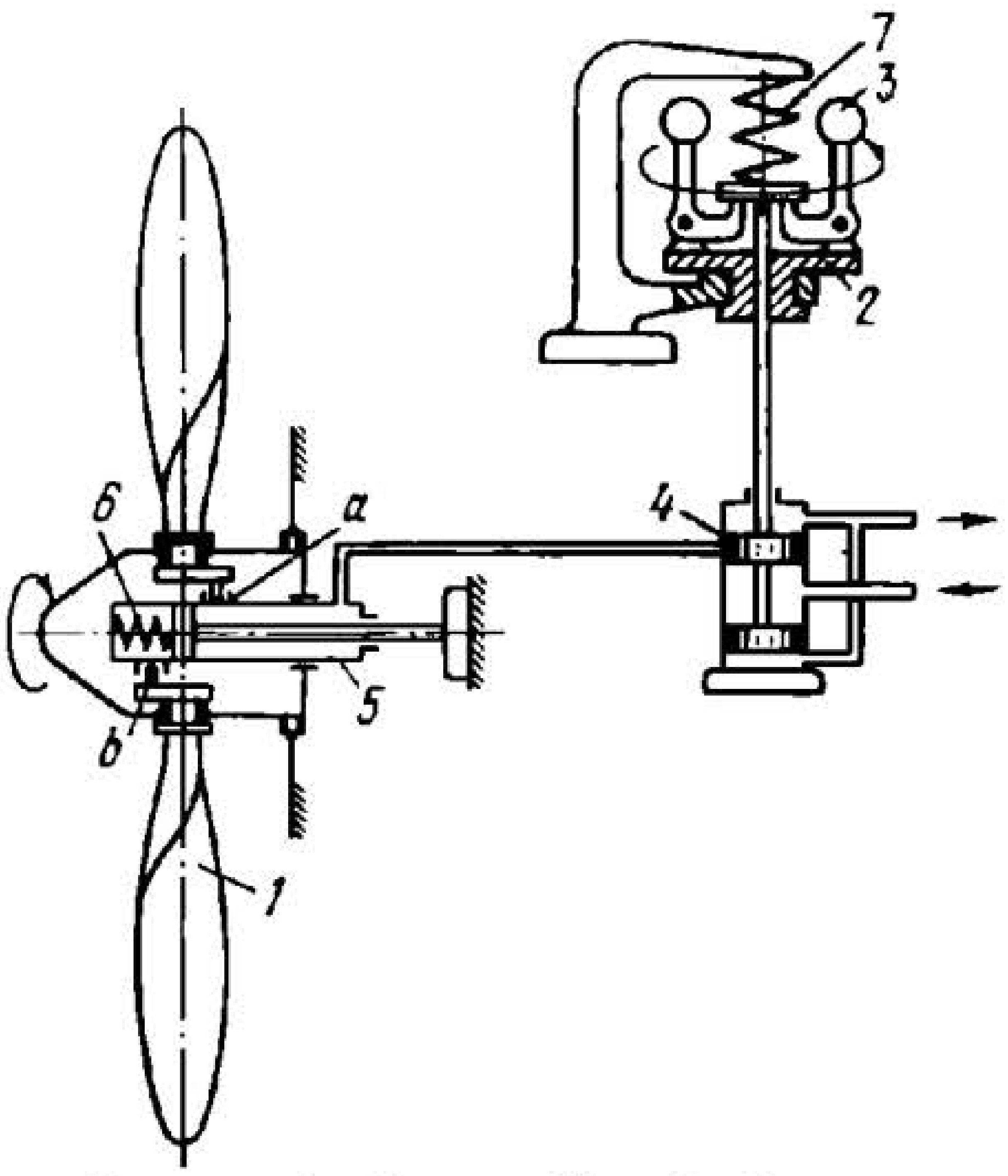


Upon an increase in engine speed, balls *a* of centrifugal governor *1* move outward, shifting valve spool *2* to the left. At this, pump *3* delivers hydraulic fluid through the valve to the left end of cylinder *4*, moving piston *5* to the right so that contact *d*, mounted on piston rod *6*, makes contact with contact *b*, switching on the mechanism for increasing the pitch of the propeller. When the pitch is increased, the speed of the engine is reduced to the preset valve. Fluid from the right end of cylinder *4* and from the valve is discharged to the suction line of pump *3*. Upon a reduction in engine speed, valve spool *2* is shifted to the right by spring *9*, blocking off fluid delivery to cylinder *4*. Then spring *8* moves piston *5* to the left, closing movable and stationary contacts, *d* and *f*, to switch on the mechanism for reducing the propeller pitch. Relief valve *7* protects the system against overloads. The regulator can be set up for any required engine speed by turning lever *10* which, through gear rack *11*, regulates spring *9*.



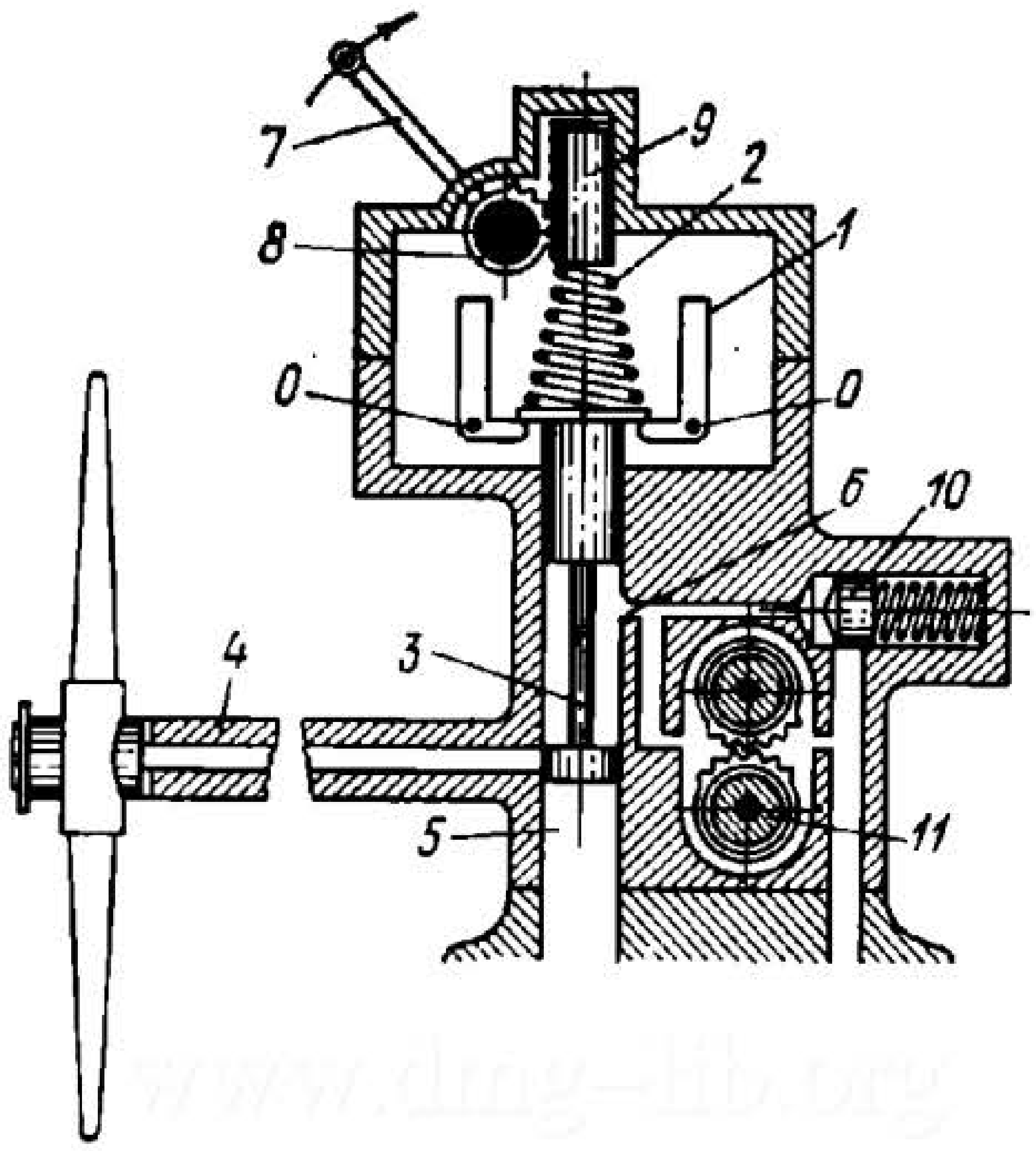
Upon an increase in engine speed, balls *a* of centrifugal governor *1* move outward, shifting valve spool *2* to the right. At this, pump *4* delivers hydraulic fluid through the valve to the right end of cylinder *5*, moving piston *6* to the left. Pin *b*, mounted on piston rod *7*, turns propeller blade *8* clockwise, increasing the propeller pitch and, consequently, reducing the engine speed to the preset value. Fluid from the left end of cylinder *5* is discharged through axial passage *d* in spool *2* to the suction line of pump *4*. Relief valve *3* protects the system against overloads. Upon a reduction in engine speed, balls *a* move inward, valve spool *2* is shifted to the left by spring *9*, fluid from the pump is delivered to the left end of cylinder *5*, moving piston *6* to the right. At this, propeller blade *8* is turned counterclockwise by a spring (not shown), reducing the propeller pitch. The regulator can be set up for any required engine speed by turning lever *10* which, through gear rack *11*, regulates spring *9*.

4266	VARIABLE-PITCH PROPELLER REGULATOR MECHANISM	CHP Rg



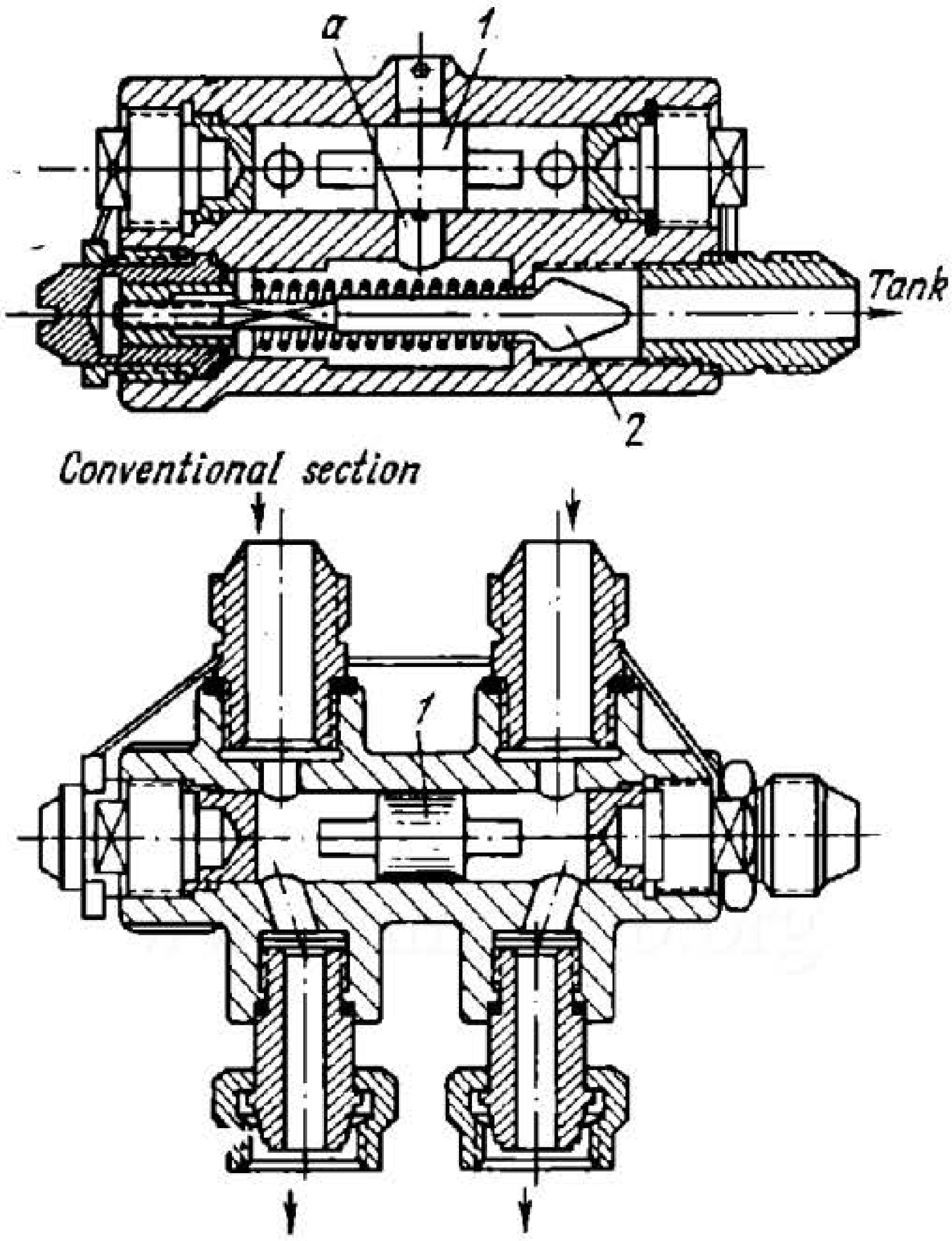
An increase in the speed of propeller *1*, driven by the aircraft engine, increases the speed of disk *2*, moving weights *3* outward and shifting valve spool *4* upward. Fluid from the valve is delivered to the cylinder of servomotor *5* whose piston is fixed. This moves the cylinder axially to the right and, by means of pins *b*, guide lugs *a* on the cylinder turn the blades of propeller *1* about their axes to increase the propeller pitch. This reduces the engine (and propeller) speed. Upon a reduction in propeller speed, spring *7* shifts valve spool *4* downward, spring *6* forces the fluid out of the cylinder of servomotor *5* and moves the cylinder to the left, reducing the pitch of the propeller and increasing the engine (and propeller) speed.

4267	AIRCRAFT ENGINE SPEED REGULATOR MECHANISM	CHP Rg



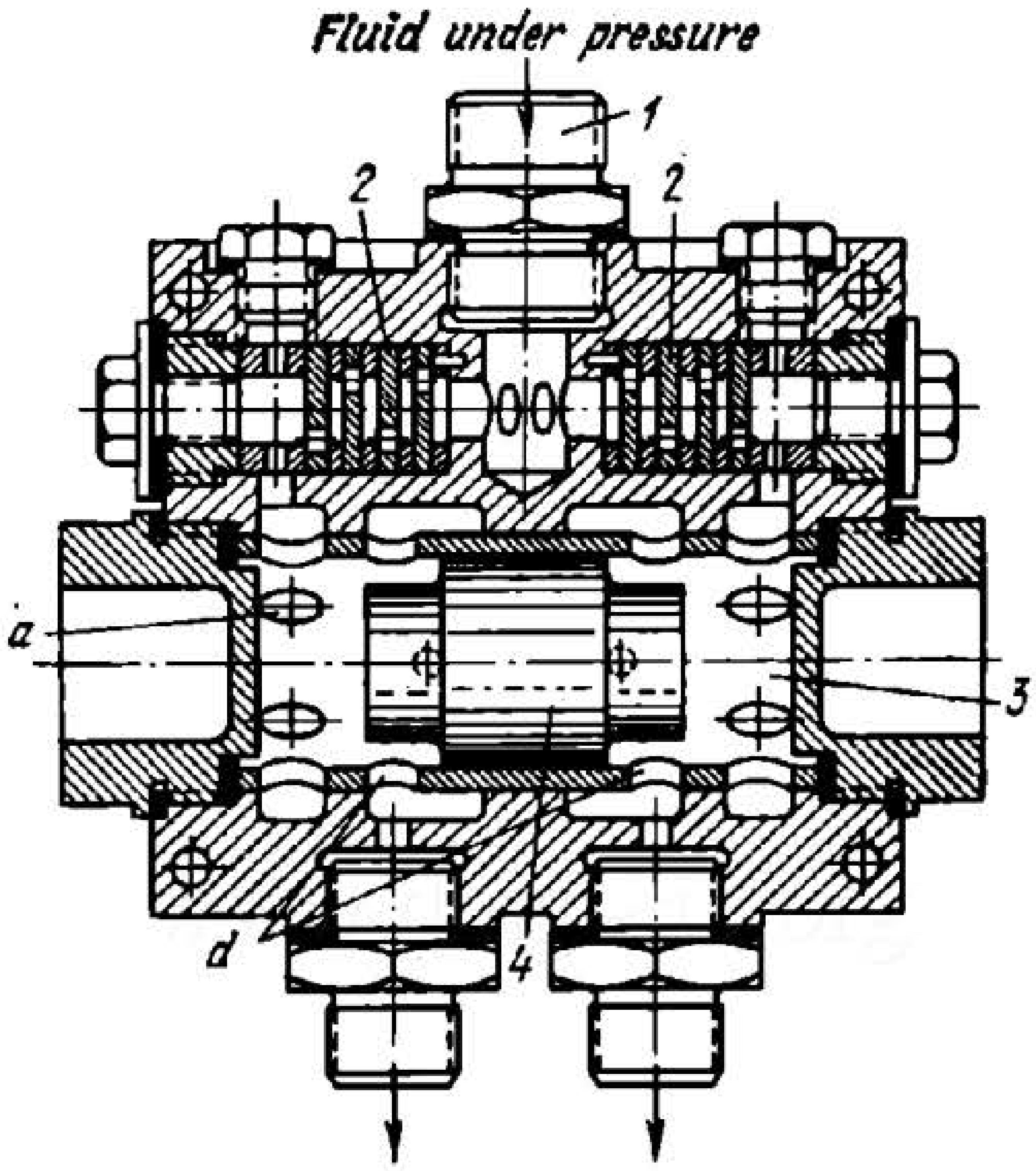
Upon an increase in engine speed, weights *1* of the centrifugal governor move outward and, turning about axes *O*, compress conical spring *2*. This raises valve spool *3* and hydraulic fluid from sleeve *4* is discharged through channel *5* to the engine crankcase. As a result, the propeller pitch increases, increasing the power required to drive the propeller and, consequently, reducing the engine speed. At this, weights *1* turn in the opposite direction, spring *2* shifts spool *3* downward, blocking off fluid discharge to the crankcase, and fixing a definite position of the blades and propeller pitch. Upon a reduction in engine speed, weights *1* move inward, spool *3* is shifted downward, connecting channel *6*, to which fluid is delivered under pressure, to the space in sleeve *4* of the propeller. This fluid turns the blades, reducing the pitch and the power required to drive the propeller and, consequently, increasing the engine speed. The required propeller (and engine) speed is set up by regulating conical spring *2*. This is done by turning lever *7* which is attached to pinion *8*. The pinion meshes with gear rack *9* which regulates the compression of spring *2*. Valve *10* serves to by-pass fluid delivered by gear pump *11* when spool *3* is in its neutral and upper positions.

4268	SAFETY REGULATOR MECHANISM FOR AIRCRAFT BRAKE GRIDS	CHP Rg



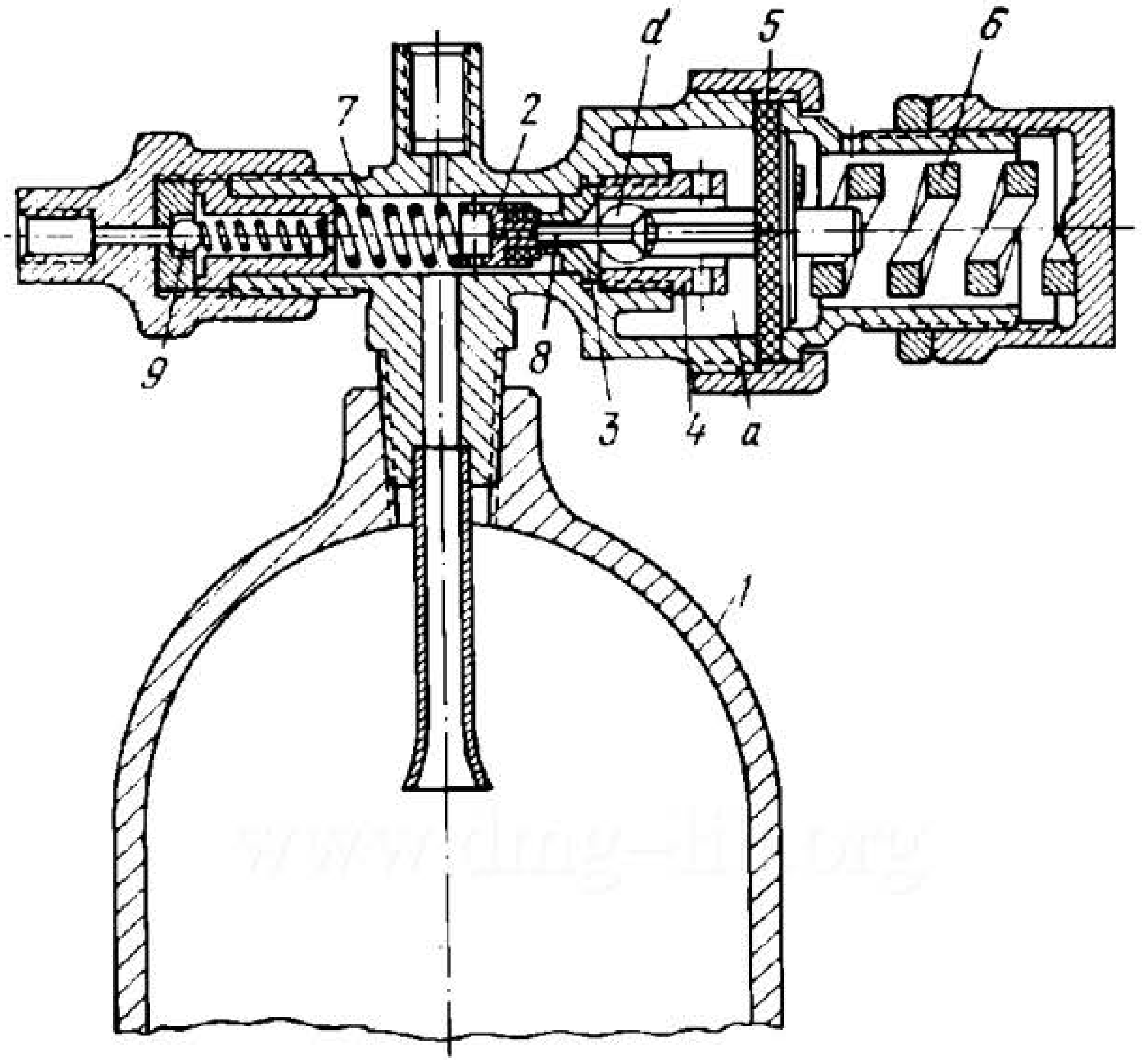
The safety device is connected in series to the throttling portioner. Upon an increase in pressure at one end of floating plunger *1*, having channels in its housing at both ends through which hydraulic fluid is delivered to the grid control cylinders, the plunger is shifted, admitting fluid through port *a* of surplus pressure valve member *2*. The fluid, which is directed by the throttling portioner to the side where the grids are already extended, has an outlet so that its flow begins again and plunger *1* is moved back. At this, plunger *1* admits fluid to the side where the grid has not yet been fully extended. When the second grid reaches its extreme extended position, plunger *1* returns to its central position, blocking off the port to the surplus pressure valve member *2*.

4269	THROTTLING PORTIONER MECHANISM FOR AIRCRAFT BRAKE GRIDS	CHP Rg



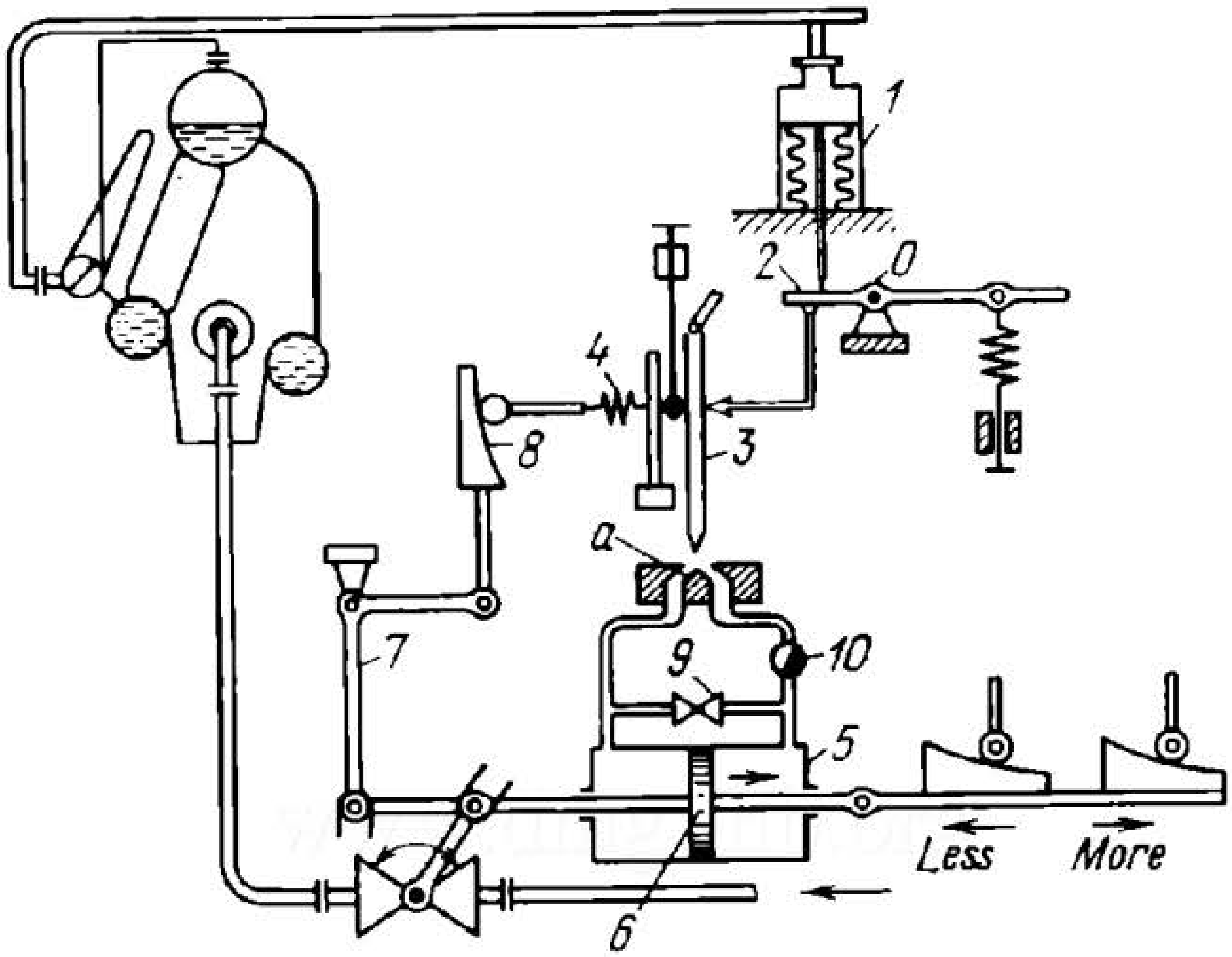
Hydraulic fluid under pressure, admitted through connection *1*, passes through throttling devices *2*, consisting of a set of washers of equal resistance, and ports *a* into sleeve *3* at both ends of floating plunger *4*. Plunger *4*, subject to equal fluid pressures, is positioned between ports *d*, through which fluid is delivered to the brake grid control cylinders. If one of the grids is jammed or the friction is unequal in their mechanisms, the two rates of fluid flow become unequal, and the pressure drops at the side of greater flow. This shifts plunger *4* toward this side and it closes ports *d* to some extent, admitting less fluid until the pressure is equalized at both ends. Plunger *4* has extensions of smaller diameter at both ends to prevent it from completely blocking off ports *d*.

4270	**PRESSURE REDUCER MECHANISM FOR THE COMPRESSED AIR CYLINDER OF AN AIRCRAFT EMERGENCY SYSTEM**	CHP Rg



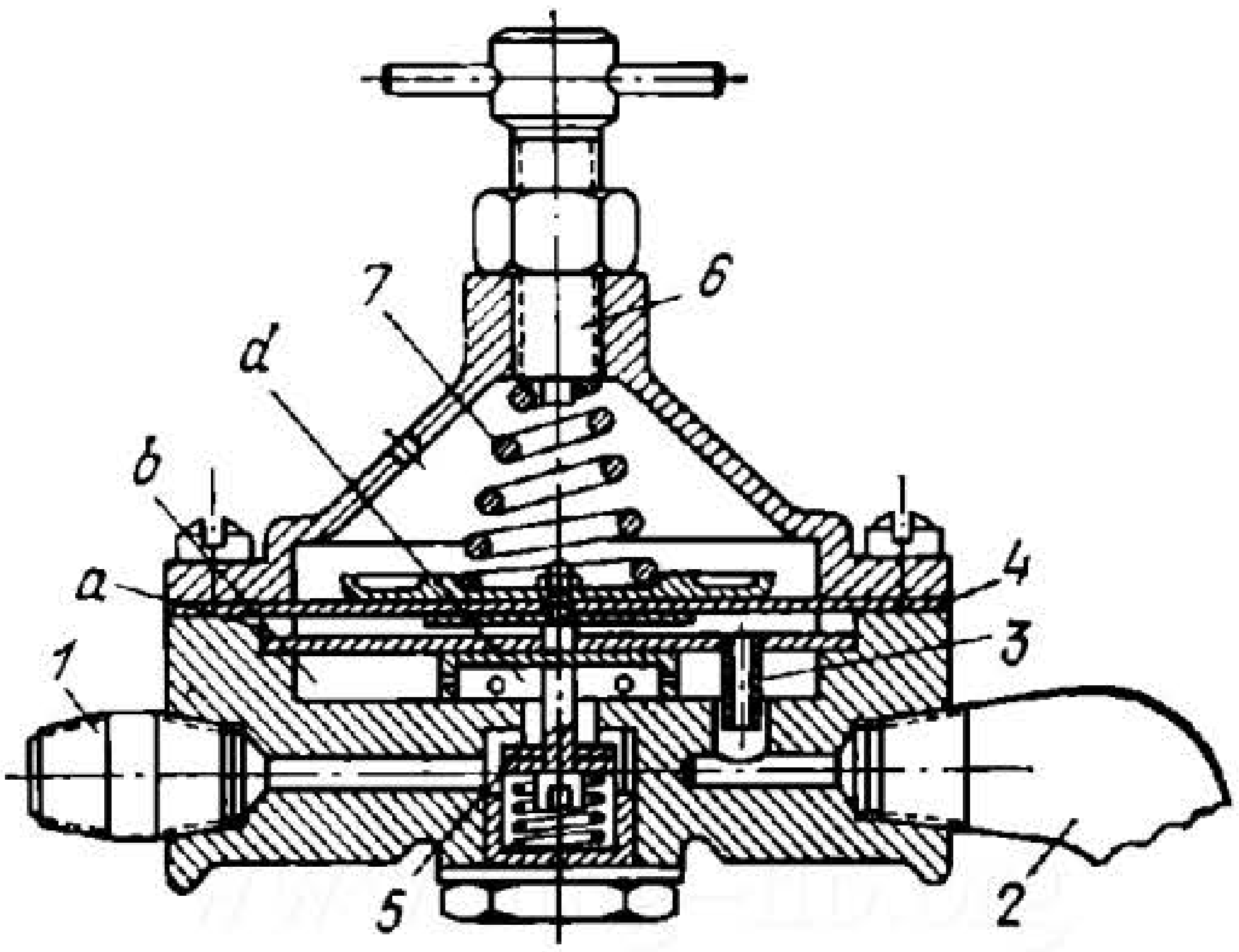
When the emergency system is in operation, air from cylinder *1* is admitted through the orifice in valve member *2* and through bushings *3* and *4* into chamber *a*. Here the air bends diaphragm *5* to the right, compressing spring *6*. At this, rod *8* is moved to the right by spring *7*, allowing valve member *2* to seat on bushing *3* as shown. This shuts off air flow from the cylinder to chamber *a* whose port *d* leads to the emergency system. As the compressed air is used up in the system, the pressure drops in chamber *a* and rod *8*, actuated by spring *6*, opens valve member *2* again. The pressure of the air in the emergency system is controlled by the force exerted by spring *6*. Ball valve *9* serves to recharge the cylinder with compressed air.

4271	STEAM PRESSURE REGULATOR MECHANISM	CHP Rg

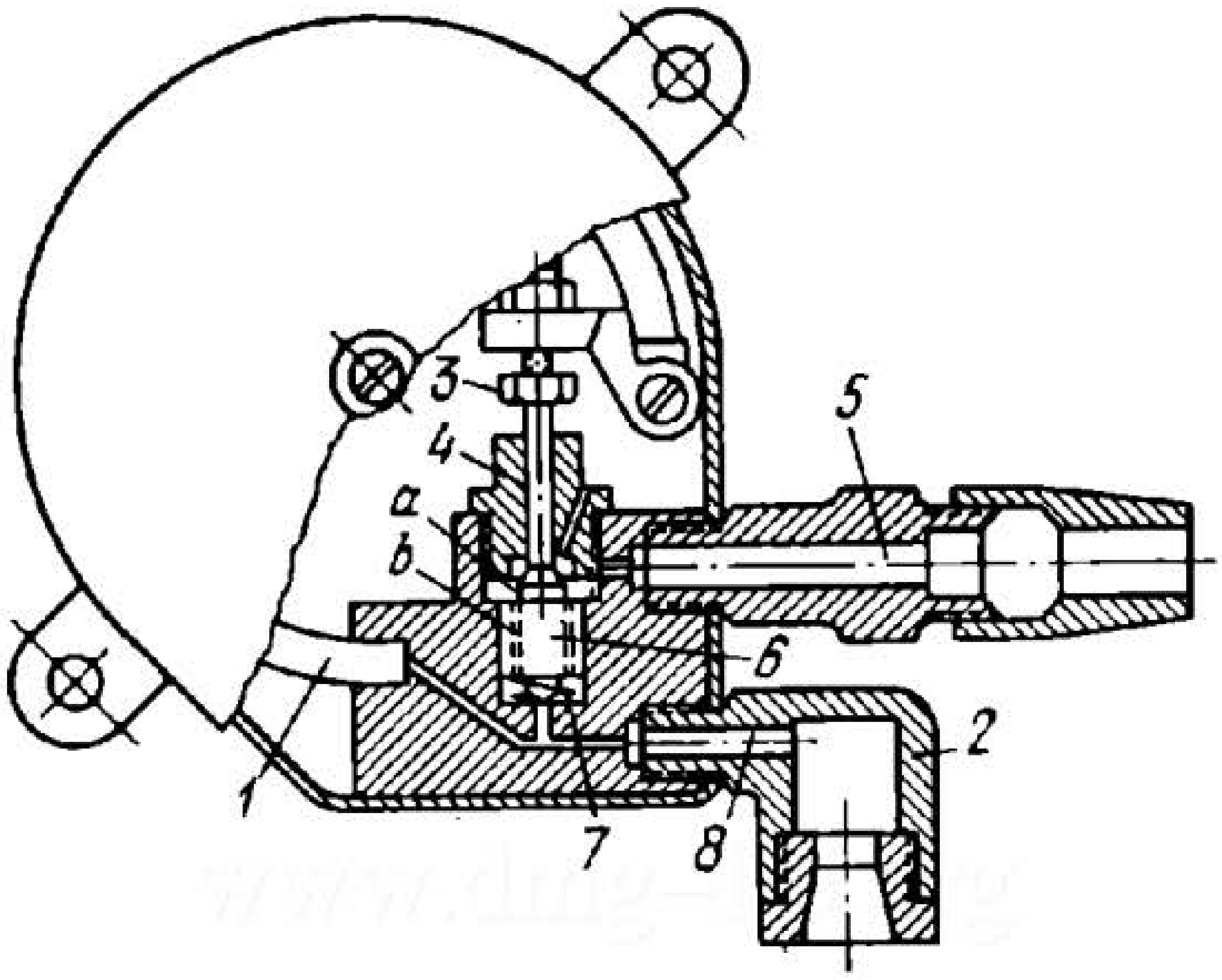


When the steam pressure drops in the boiler, bellows 1 expands, turning lever 2 about fixed axis O. This deflects jet valve nozzle 3 to the left. Hydraulic fluid from the jet valve is directed through left channel a to the left end of servomotor 5, moving piston 6 to the right and thereby increasing the fuel and air supply to the boiler. As piston 6 moves to the right, lever 7 raises cam 8, compressing spring 4, which returns jet valve nozzle 3 to the central position. The regulator is switched off with valve 9 which, in the open position, connects the two ends of servomotor cylinder 5, equalizing the pressure in them regardless of the position of jet valve nozzle 3. Flow-control valve 10 regulates the rate of fluid flow to the servomotor. Upon an increase in pressure in the boiler, the elements of the regulator operate in the reverse direction.

4272	PRESSURE STABILIZER MECHANISM	CHP Rg

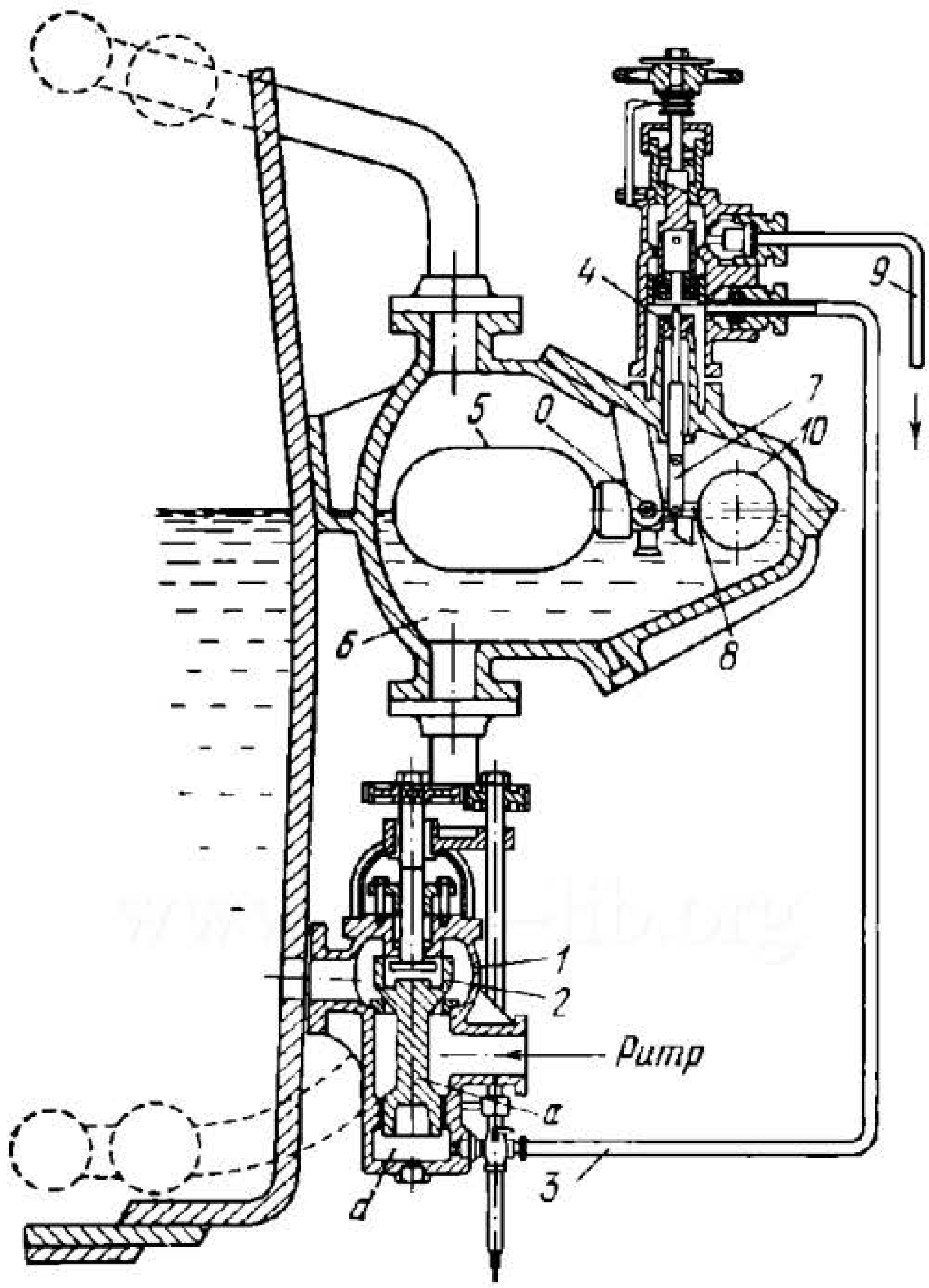


Through port *1* compressed air is admitted into internal chamber *d*. From here it passes through a number of radial orifices into chamber *b*. From this chamber, the air, at reduced pressure, passes through port *2* to the system. A part of the air passes through tube *3* into chamber *a*. The pressure of the air bends membrane *4* upward, shifting valve member *5* and thereby changing the amount of air admitted. The stabilizer is regulated to the required pressure with screw *6* which compresses spring *7*, varying the resistance of the spring to the bending of membrane *4*.



One end of Bourdon tube *1* is connected by passage *8* to air tank *2*, and the second, sealed, end is linked to regulating screw *3* of valve member *4*. Chamber *a* of the valve is connected by passage *5* to the idling device of the compressor (not shown), and by passage *b* to the atmosphere. Located under valve *4* is plunger *6* whose conical tip blocks off passage *8*. Upon an increase in pressure in the air tank, Bourdon tube *1* tends to straighten out, reducing the pressure exerted on valve *4*. Then plunger *6*, subject to increased pressure and the force of spring *7*, moves upward, lifting valve *4*. Passages *5* and *8* are connected together through hole *b* in plunger *6* and valve member *4* closes the hole for air discharge to the atmosphere. The pressure from chamber *a* is transmitted to the membrane of the idling device. This switches off the compressor delivering air into tank *2*. As a result, the pressure in the tank is reduced.

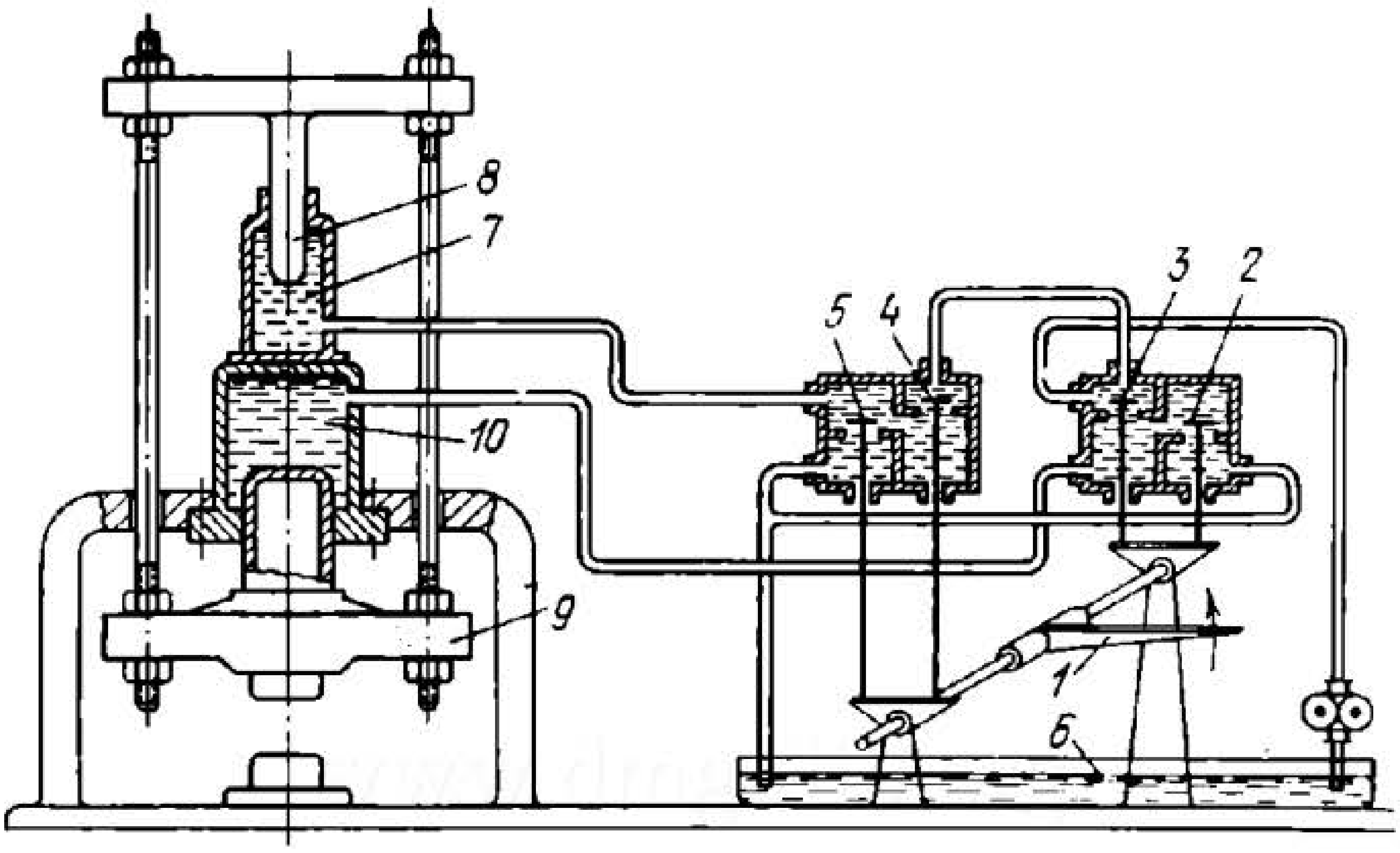
4274	BOILER WATER LEVEL REGULATOR MECHANISM	CHP Rg



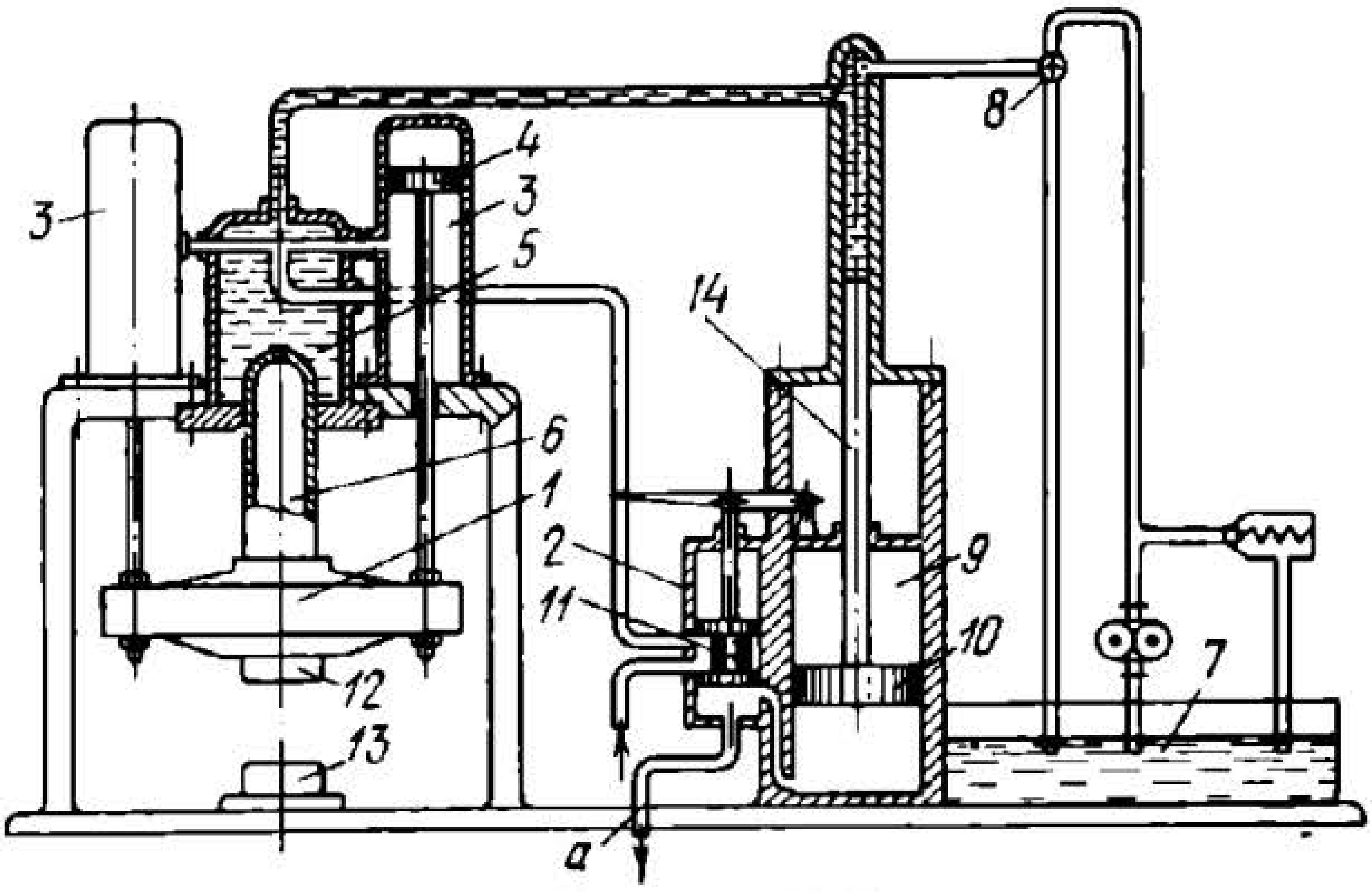
Valve body *1* is connected by ports to the water space in the boiler and to the feedwater pump. Feedwater from the pump is delivered through valve member *2* into the boiler and through the clearance between plunger *a* and body *1* into space *d*. From here it is discharged through pipeline *3*, needle valve *4* and pipeline *9* to the suction line of the pump. From above, valve member *2* is subject to the pressure of the water in the boiler and is therefore held tightly to its seat. When the level drops in the boiler, float *5*, located in chamber *6*, moves downward, turning about fixed axis *O*. Chamber *6* is connected to both the steam and water spaces of the boiler. Needle valve member *4*, linked by tie-rod *7* to float lever *8*, moves upward and stops water discharge from space *d* to the suction line of the pump. The pressure in space *d* increases and valve member *2* is raised. At this, feedwater is delivered by the pump into the boiler until the level reaches the preset value. After this, float *5*, counterbalanced by weight *10*, rises, needle valve member *4* moves downward, connecting space *d* with the suction line. Valve member *2* returns to its seat.

3. HAMMER, PRESS AND DIE MECHANISMS
(4275 and 4276)

4275	HYDRAULIC PRESS MECHANISM	CHP HP



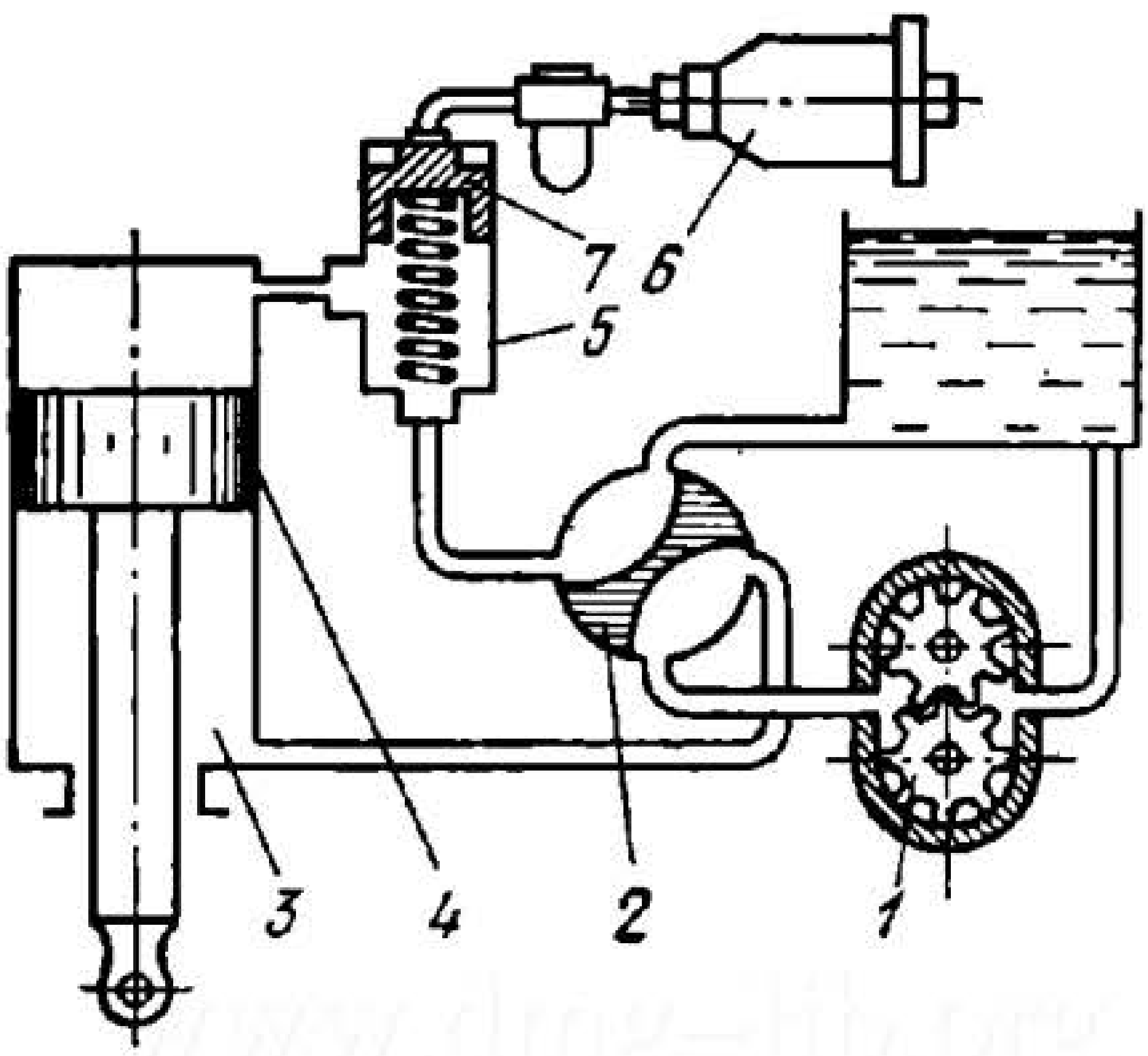
When lever *1* is turned counterclockwise, valve members *3* and *5* are lowered, and valve members *2* and *4* are raised, and fluid under pressure is delivered from tank *6* to upper cylinder *7* of the press. Plunger *8* is moved upward by the pressure of the fluid, raising crosshead *9* so that the fluid forced out of lower cylinder *10* is discharged to the tank. When lever *1* is turned clockwise, valve members *3* and *5* are raised and valve members *2* and *4* are lowered. Fluid is delivered to lower cylinder *10*. Crosshead *9* is moved downward by the pressure of the fluid and applies pressure to the stock between the anvils. In the central position of lever *1*, crosshead *9* stops at the required height.



To raise press head *1* to the required height, steam is delivered from valve chest *2* to pull-back cylinders *3* and pull-back pistons *4* are moved upward by steam pressure. At this, hydraulic fluid is forced out of ram cylinder *5* by ram *6* and is discharged to tank *7* through valve *8*. Steam from intensifier cylinder *9* is exhausted to the atmosphere through pipe *a*. Intensifier piston *10* is in its lower position. To lower press head *1*, valve spool *11* is shifted upward, steam from cylinders *3* is exhausted to the atmosphere, and pistons *4* move downward together with press head *1*. At this, fluid is drawn in through open valve *8* into ram cylinder *5*. When top die *12* lies on billet *13*, valve *8* is closed and steam is admitted into intensifier cylinder *9*. Intensifier piston *10* moves upward and its hydraulic ram *14* applies pressure to the fluid, actuating top die *12* to perform the pressing operation.

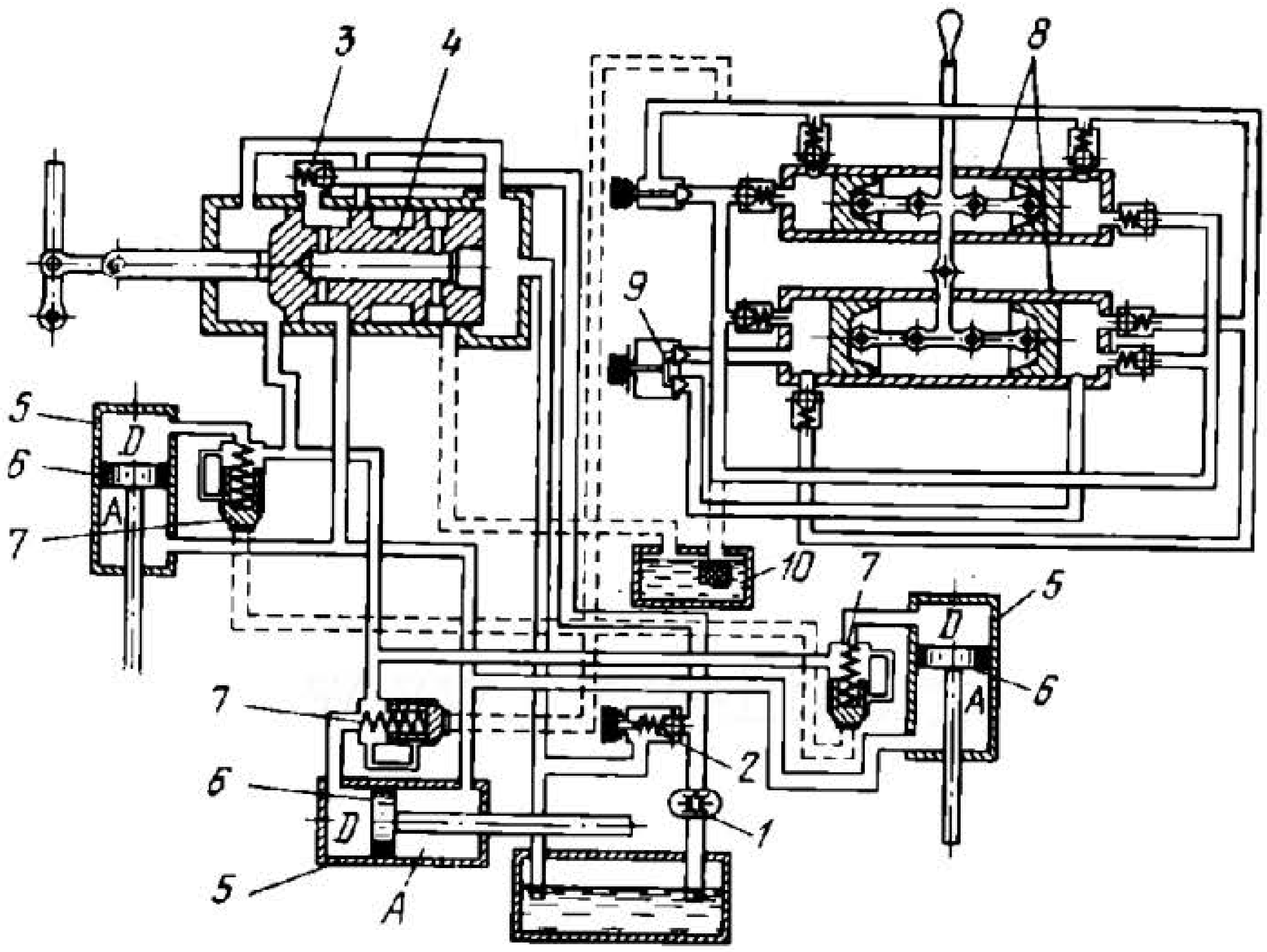
4. AIRCRAFT LANDING GEAR MECHANISMS
(4277 through 4281)

4277	EMERGENCY CARTRIDGE MECHANISM FOR LOWERING AIRCRAFT LANDING GEAR	CHP AL



Under normal operational conditions, gear pump *1* delivers hydraulic fluid through rotary directional valve *2* to the lower end of power cylinder *3*. Piston *4* is moved upward by the fluid, retracting the landing gear of the plane. Fluid from the upper end of cylinder *3* passes through emergency valve *5* and is discharged by valve *2* to the tank. Valve *2* is turned to lower the landing gear. In case of a failure of the hydraulic system, emergency cartridge *6*, included in the drive, is put into operation. By means of a firing pin, special substances are ignited in the cartridge and the evolved gaseous products of combustion are directed to emergency valve *5* where they force back piston *7* of the valve and are admitted into the upper end of power cylinder *3*. The gases move piston *4* downward, lowering the landing gear.

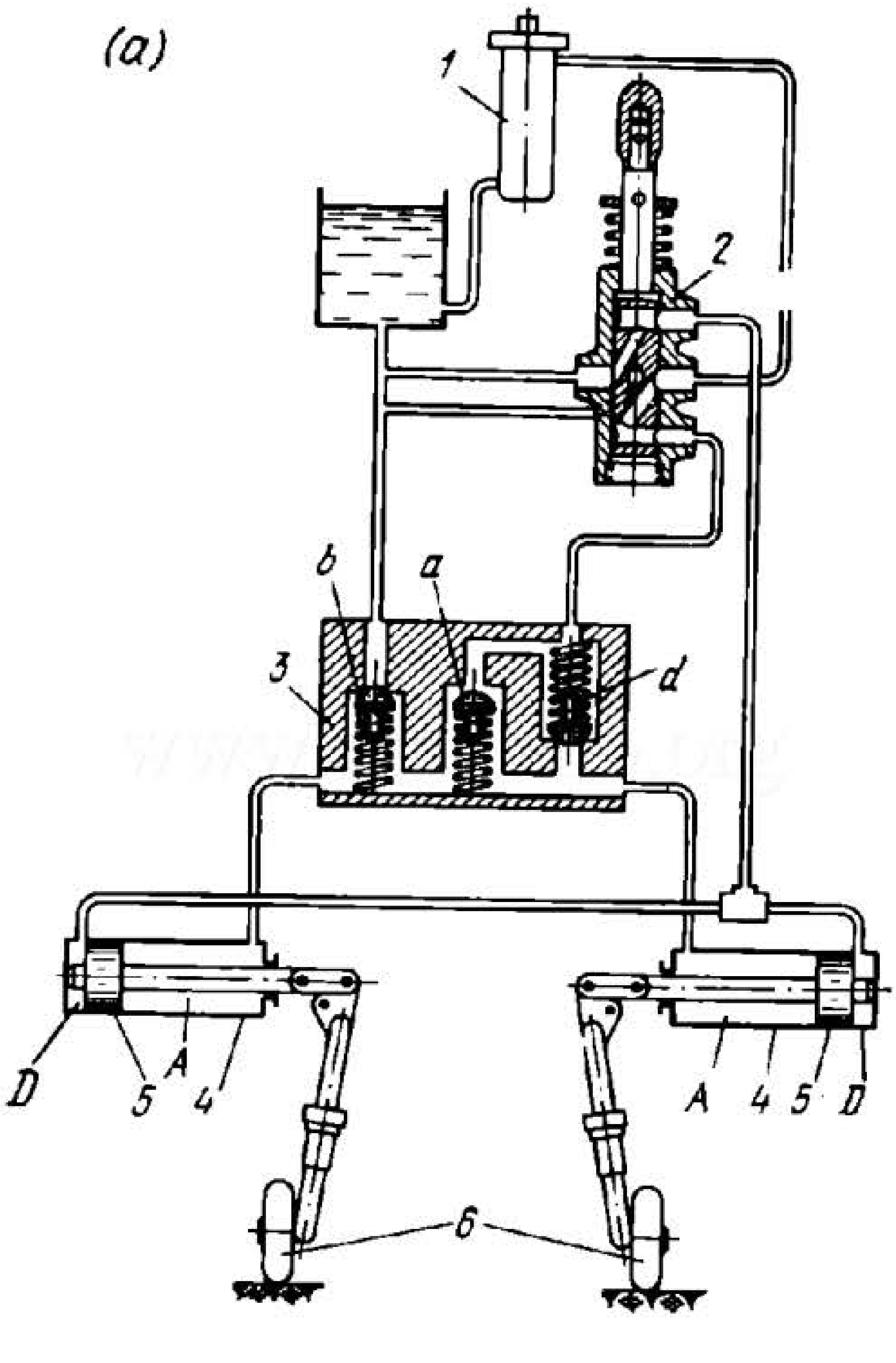
4278	AIRCRAFT LANDING GEAR AND SKID MECHANISM WITH AN EMERGENCY LOWERING FEATURE	CHP AL

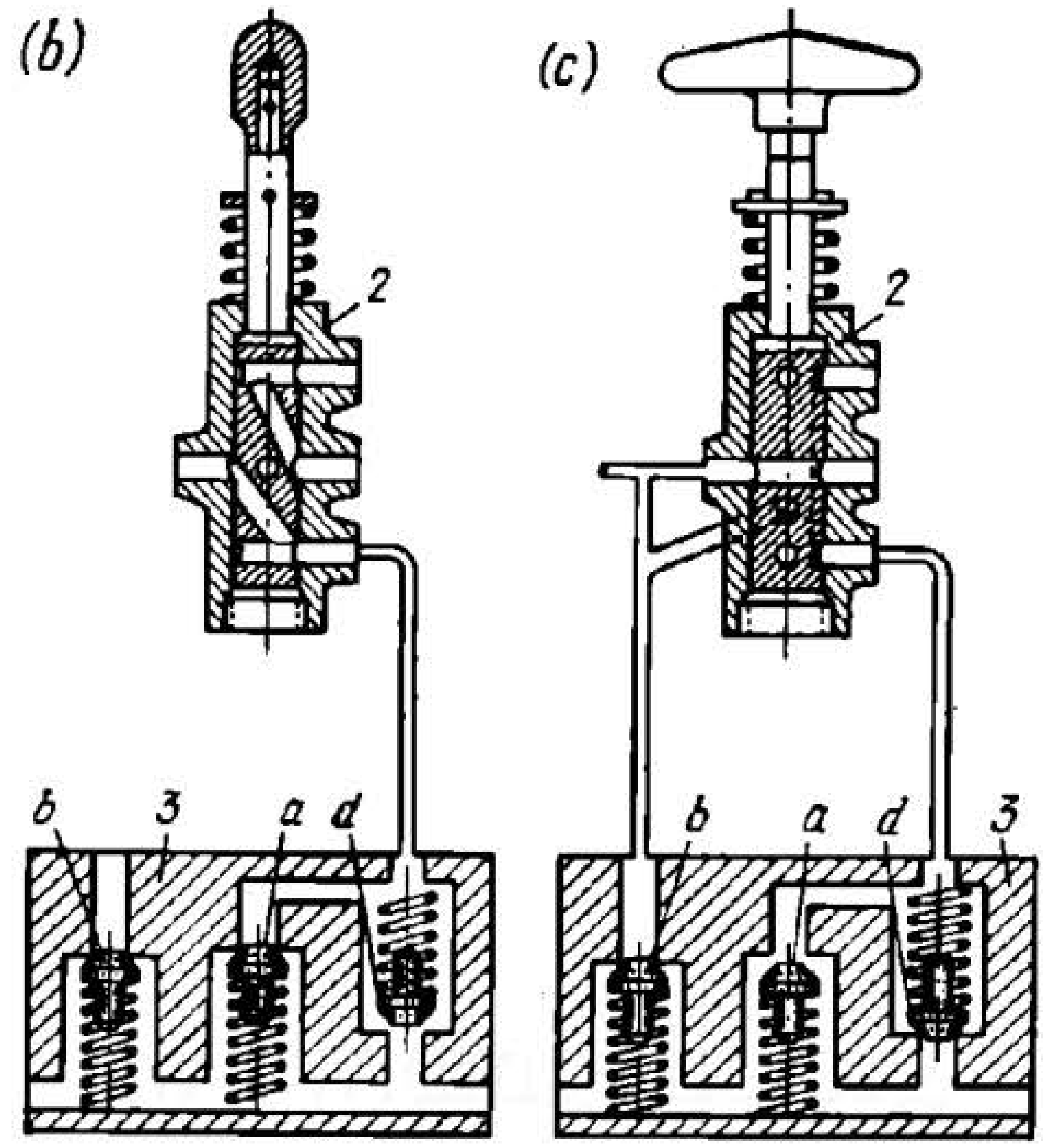


Pump *1* delivers hydraulic fluid, at a pressure controlled by relief valve *2*, through check valve *3* into a directional valve with spool *4* which directs the fluid to ends *A* of power cylinders *5*. This moves pistons *6* which retract the landing gear and skid. From ends *D* of the cylinders, fluid is discharged through valves *7* and the directional valve to the tank. When the landing gear is in the retracted position, limit switches switch off the electric motor that drives pump *1*. In the extreme left-hand position of valve spool *4*, the landing gear and skid are lowered. At this, fluid is delivered by the pump through the directional valve and check valves *7* to ends *D* of power cylinders *5*. Fluid from ends *A* is discharged through the directional valve to the tank.

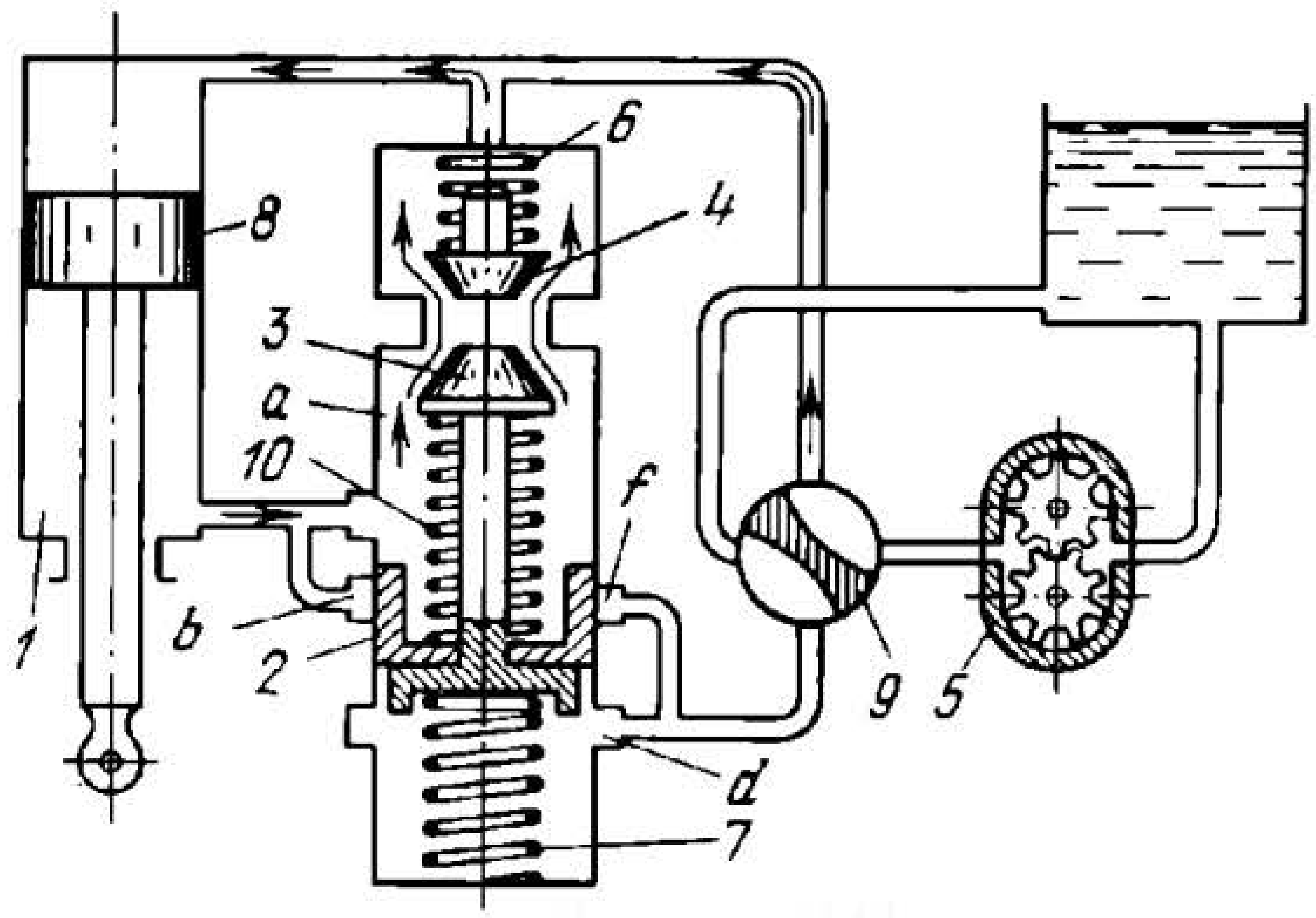
Valve *3* serves as a hydraulic seal to hold the landing gear and skid in the lowered position. In the extreme right-hand position of valve spool *4*, corresponding to emergency lowering of the landing gear and skid, the ports for delivering fluid from the pump are blocked off and ends *A* are connected through an axial passage in spool *4* to emergency tank *10*. In this case, fluid for lowering is delivered by high- and low-pressure manual pumps *8*, the low-pressure pump being switched off at the end of the lowering operation by valve *9*. Fluid from manual pumps *8* is delivered along pipelines shown by dash lines through valves *7*, forcing back their plungers, into ends *D* of power cylinders *5*, thereby lowering the landing gear.

(a)

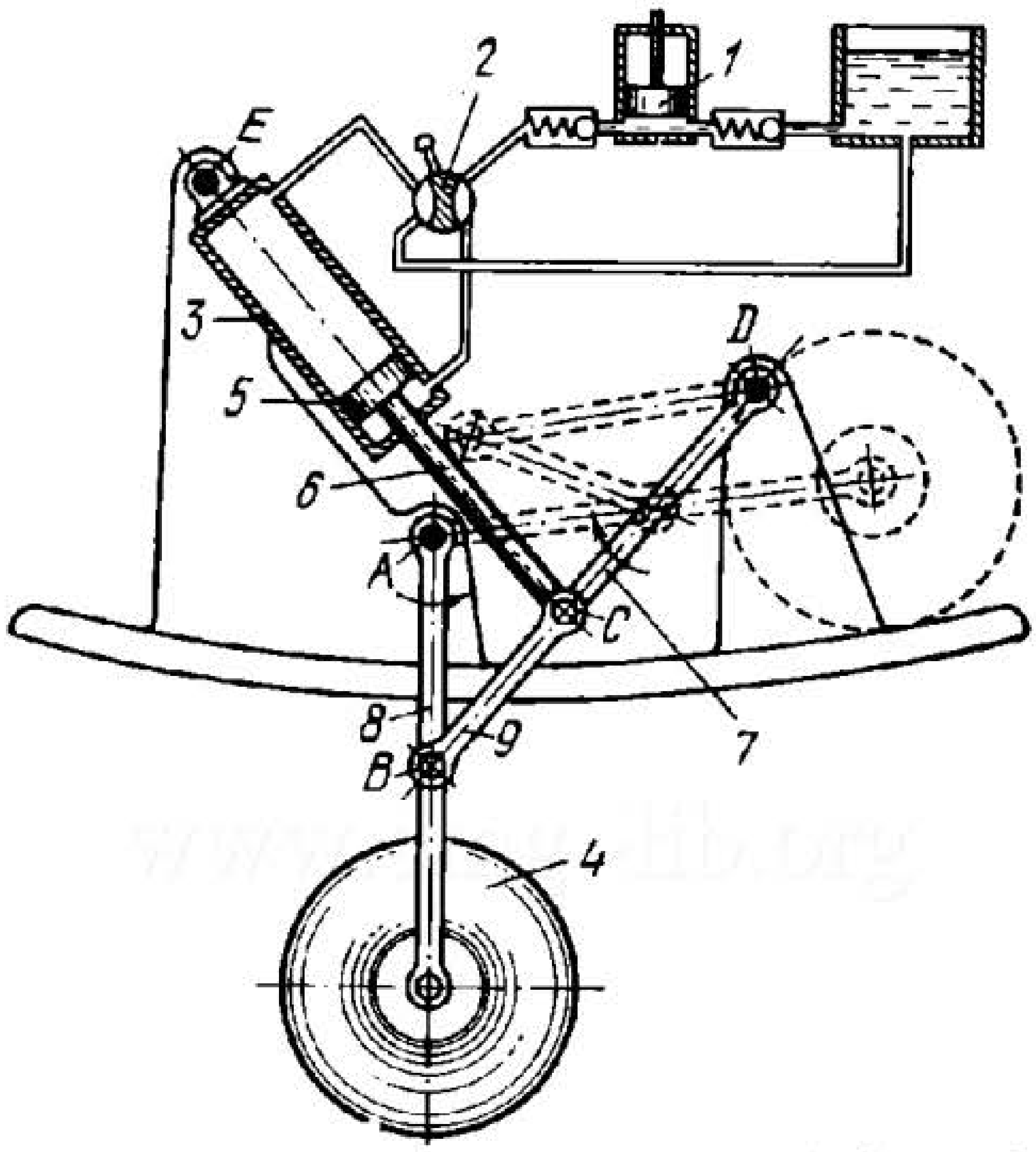




Rotary screw pump *1* delivers hydraulic fluid through directional valve *2* and valve member *a* of valve box *3* to ends *A* of power cylinders *4*. This moves pistons *5* to lower landing gear *6*. Fluid from ends *D* is discharged through directional valve *2* to the tank (see Fig. *a*). To retract the landing gear, valve *2* is turned to the position shown in Fig. *b*. Fluid from the pump is delivered through valve *2* to ends *D*, moving pistons *5* and retracting landing gear *6*. Fluid from ends *A* is discharged through valve member *d* of valve box *3* and valve *2* to the tank. Upon a failure in the hydraulic system, emergency lowering of the landing gear is due to its own weight. In this case, valve *2* is turned to the neutral position (shown in Fig. *c*). Since in lowering the landing gear by its own weight it is lowered at such a high rate that pump *1* is incapable of filling the spaces evacuated by pistons *5*, these spaces are filled with fluid directly from the tank through valve member *b* which opens due to the vacuum in ends *A*. Fluid discharged from ends *D* passes through valve *2* and valve member *b* to ends *A*. Surplus fluid, due to the difference in effective areas of piston *5* in ends *A* and *D*, is discharged to the tank. The fluid is throttled by valve members *a* and *d* to prevent heavy impacts at the end of the piston strokes.

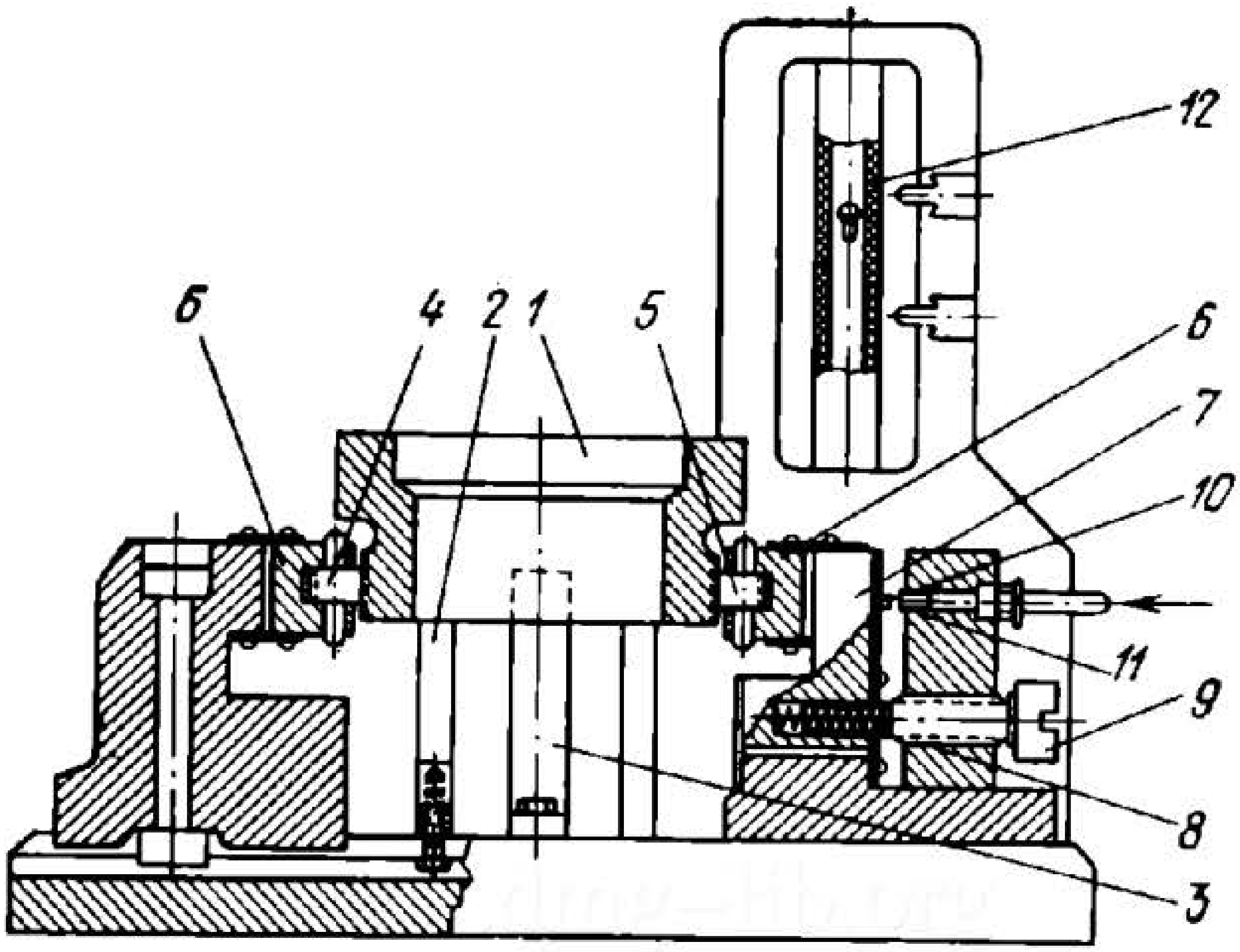


As the landing gear is lowered, its weight acts on the fluid in the lower end of power cylinder *1*, forcing it out into valve chamber *a*. The fluid moves plunger *2* downward together with valve member *3*, and the fluid, raising valve member *4*, is admitted into the upper end of cylinder *1*. Fluid is also delivered by pump *5* to the upper end, moving down piston *8* and lowering the landing gear. After the landing gear has been lowered to an extent that the pressure of the fluid from its weight is no longer capable of compressing springs *6* and *7*, spring *6* closes valve member *4*. Piston *8* continues to move downward from the pressure of the fluid delivered by pump *5*. At this, fluid discharged from the lower end of cylinder *1* shifts plunger *2* downward and passes through port *f* and directional valve *9* to the tank. To retract the landing gear, valve *9* is turned 90°, fluid is delivered by pump *5* to port *d*, shifting plunger *2* upward and compressing spring *10*, and through port *b* to the lower end of cylinder *1*. This moves piston *8* upward, retracting the landing gear.



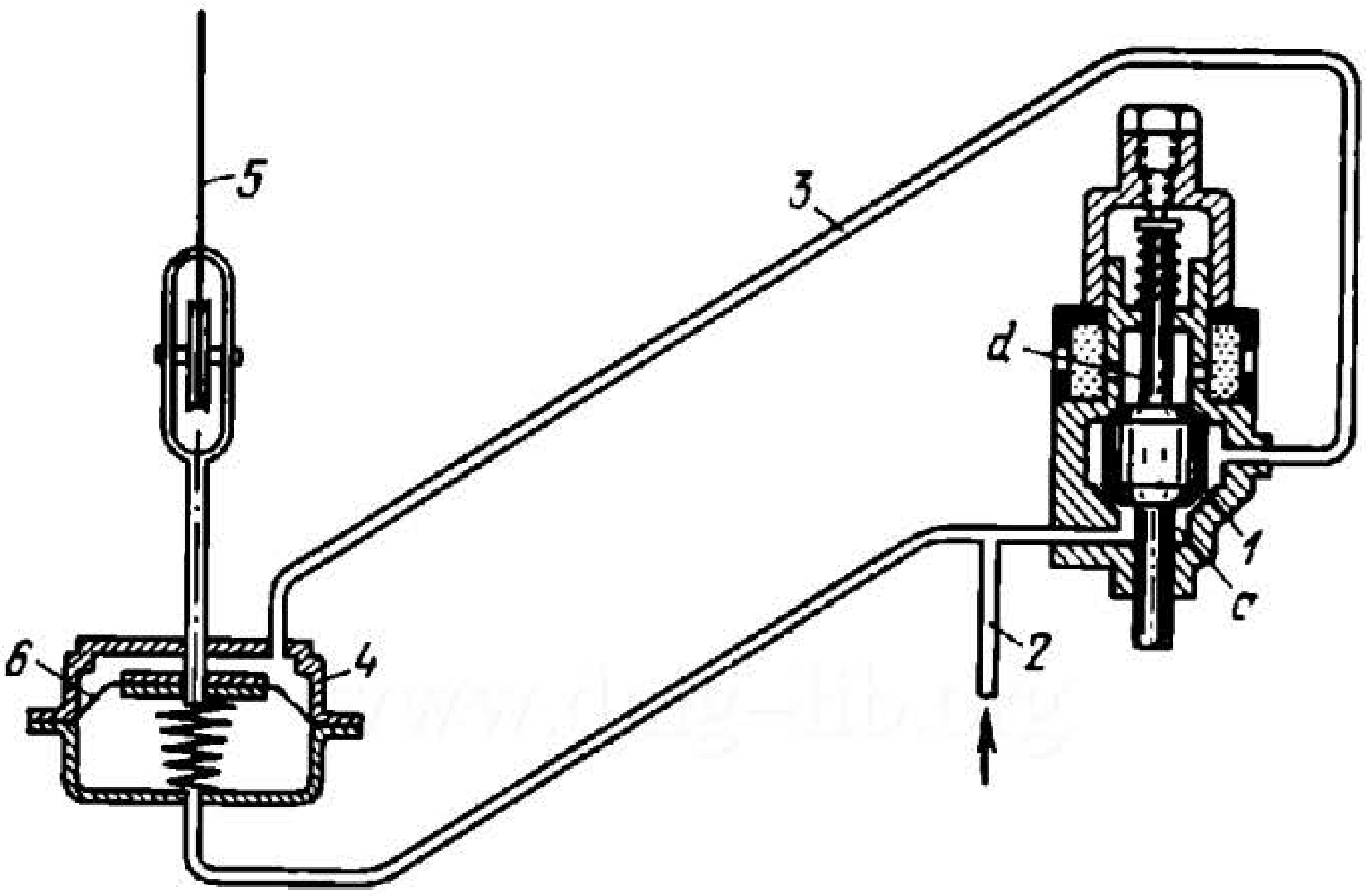
When fluid is delivered by manual pump *1* through rotary directional valve *2* to the lower end of cylinder *3*, the landing gear is retracted. The landing gear consists of wheels *4*, strut *8* and links *9* and *7*, which form the four-bar linkage *ABCD*. At this, piston *5* is moved upward by the fluid together with its rod *6*, turning link *7* clockwise and strut *8* counterclockwise until the mechanism reaches the position shown by the dash lines. Cylinder *3* turns about fixed axis *E*; the second extreme position of the cylinder is not shown. Fluid from the upper end of cylinder *3* is discharged through valve *2* to the tank. When directional valve *2* is turned to the neutral position, the landing gear retraction mechanism is held in a definite position by the fluid in cylinder *3* on both sides of piston *5*. Besides, valve *2* can be turned to the position in which fluid is delivered to the upper end of cylinder *3*, moving piston *5* downward and lowering the landing gear.

4282	PNEUMATIC FLOW-GAUGE INSTRUMENT MECHANISM FOR THREAD MEASUREMENT	CHP M



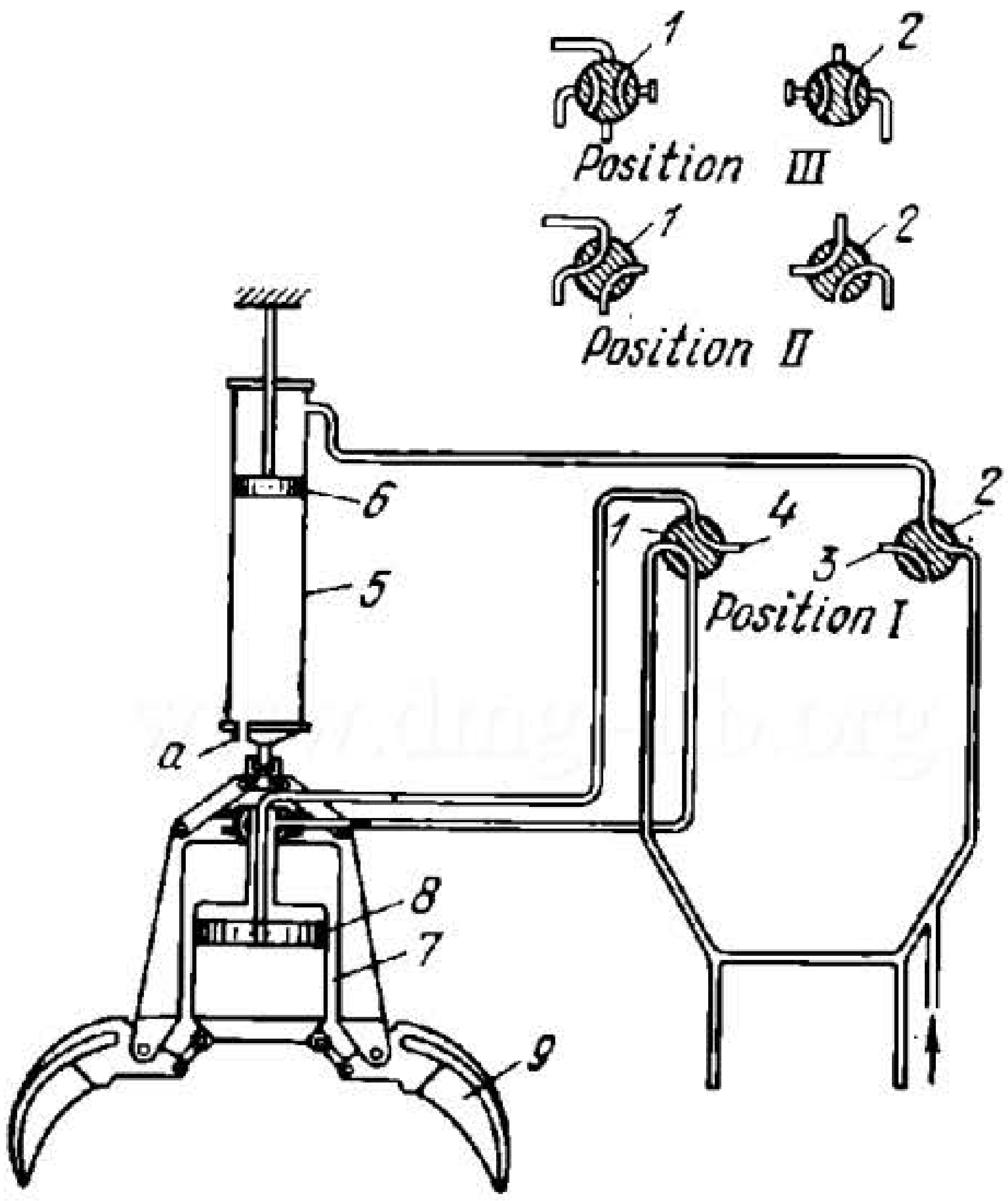
Threaded workpiece *1* is placed on supports *2* and is held tightly against locating member *3* between two measuring rollers *4* and *5*. Roller *4* is mounted in yoke *6* which is linked to the stock by four flat springs. Roller *5* is linked in a similar manner to block *7*, which is mounted on vertical springs, enabling the block to be displaced horizontally. Spring *8*, whose force can be regulated by screw *9*, holds the rollers against the thread of workpiece *1*. In checking the thread, roller *5* and block *7* are in a strictly definite position corresponding to the actual value of the pitch diameter of the workpiece thread. The position of block *7* determines the clearance between insert *10* and measuring nozzle *11* to which air is delivered from flow gauge *12*. Depending upon this clearance, the flow of air is varied through flow gauge *12*, varying the height at which the lightweight float indicator is held suspended in the internally tapered glass column. The flow gauge scale is graduated in units showing deviation in size of the thread pitch diameter. The stock and locating member can be adjusted to accommodate thread of various sizes.

4283	PNEUMATIC DRIVE MECHANISM FOR DUMPING AN EXCAVATOR BUCKET	CHP MH



In the position shown of valve spool *1*, rarified air, admitted from the receiver through pipeline *2*, fills the lower space of membrane chamber *4* and passes into chamber *a* of the valve from where it is directed to the upper space of membrane chamber *4*. When valve spool *1* is shifted downward, chamber *d* of the valve, connected to the atmosphere, is also connected to pipeline *3*. Atmospheric pressure bends membrane *6* downward, pulling cable *5* and thereby opening the bucket.

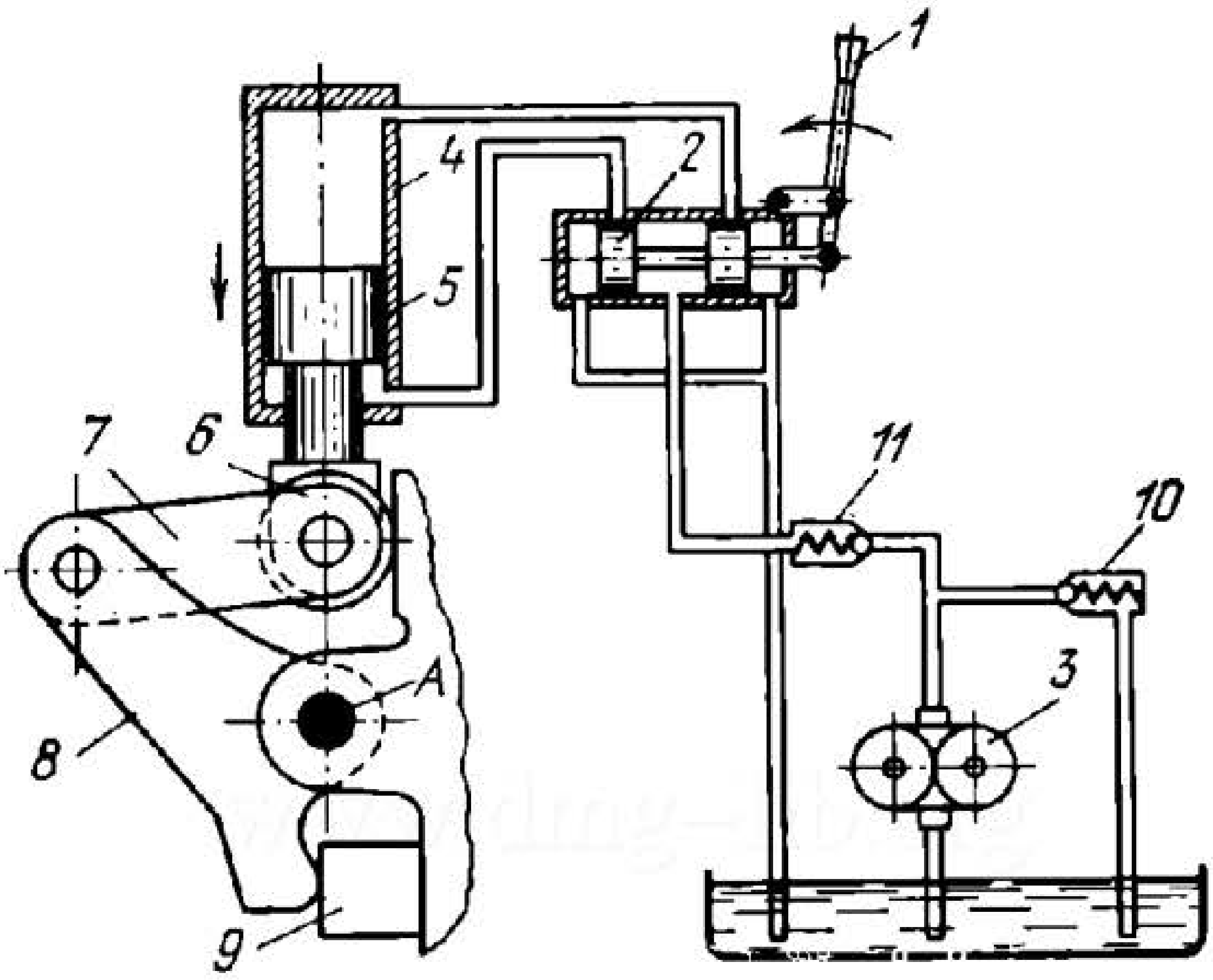
4284	PNEUMATIC DRIVE MECHANISM OF A GRAB BUCKET	CHP MH



PNEUMATIC DRIVE MECHANISM OF A GRAB BUCKET

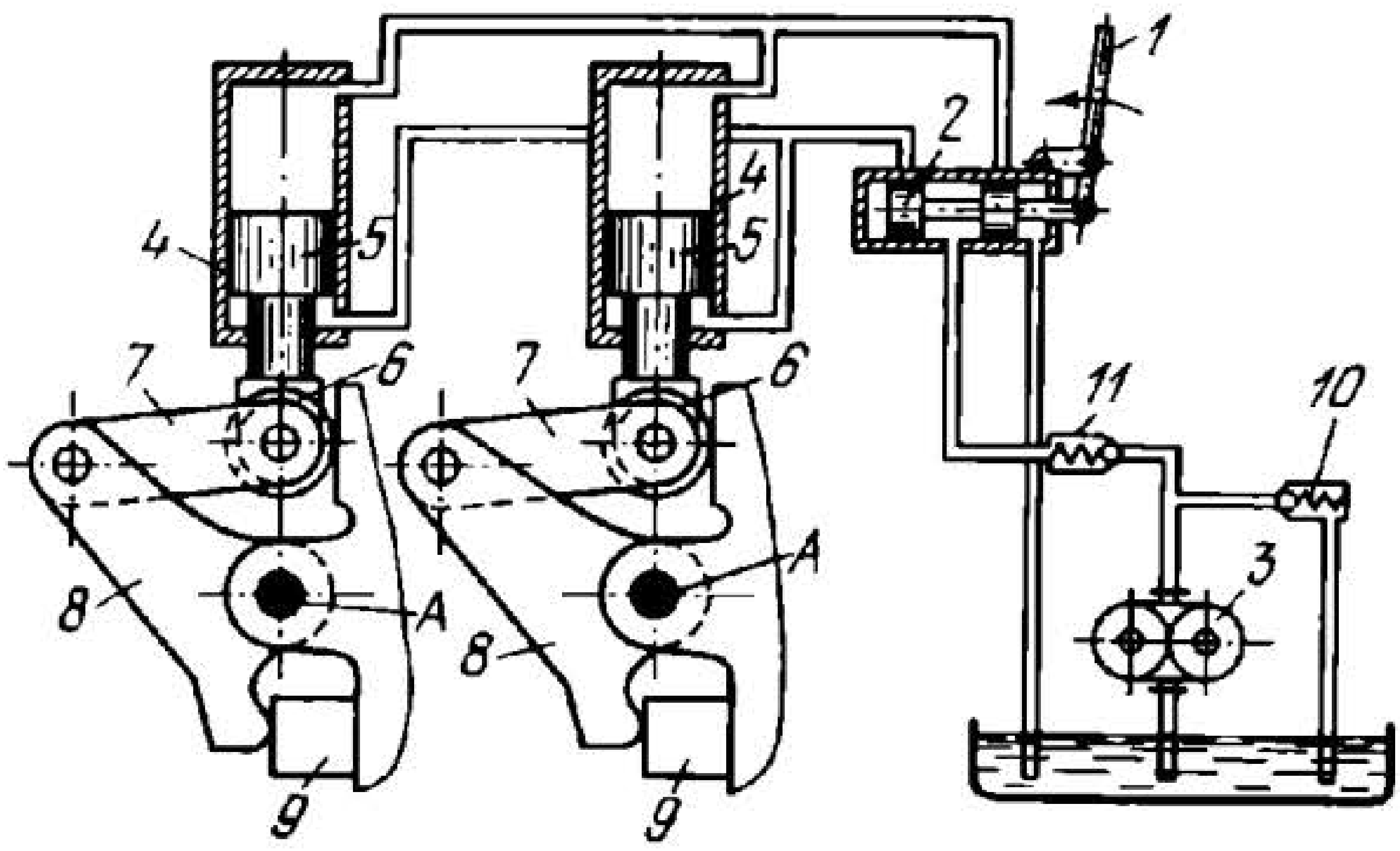
Compressed air is delivered to rotary directional valves *1* and *2* of the control levers. If valve *2* is in position *I* (as shown), air from the valve is delivered to the upper end of cylinder *5* of the hoisting unit. The pressure of the air moves cylinder *5* upward with respect to fixed piston *6*. Air from the lower end of the cylinder is discharged through port *a*. If valve *2* is in position *II*, the upper end of cylinder *5* is connected to the atmosphere. The weight of the grab bucket moves cylinder *5* downward and air from its upper end is discharged through valve *2* to channel *3* which leads to a flow-control valve. The speed at which the cylinder descends is regulated by the flow-control valve. If valve *2* is in position *III*, the pneumatic hoist is held fixed at any height. If valve *1* of the control levers is in position *I* (as shown), compressed air is delivered to the upper end of cylinder *7*. The pressure of the air moves cylinder *7* upward with respect to fixed piston *8*. This closes scoops *9* of the bucket. Air from the lower end of cylinder *7* is discharged to the atmosphere through a hole in piston *8*, valve *1* and channel *4* which leads to a flow-control valve. If valve *1* is in position *II*, compressed air is delivered to the lower end of cylinder *7*, moving it downward and opening the bucket scoops. Air from the upper end of cylinder *7* is discharged through valve *1* and a flow-control valve to the atmosphere. The speed at which the scoops are closed and opened is regulated by the flow-control valves. In position *III* of valve *1*, the scoops are held fixed at any required position. By shifting the two control levers to the corresponding positions, the pneumatic hoist and grab bucket operate simultaneously.

4285	HYDRAULIC WORK CLAMPING MECHANISM	CHP GC



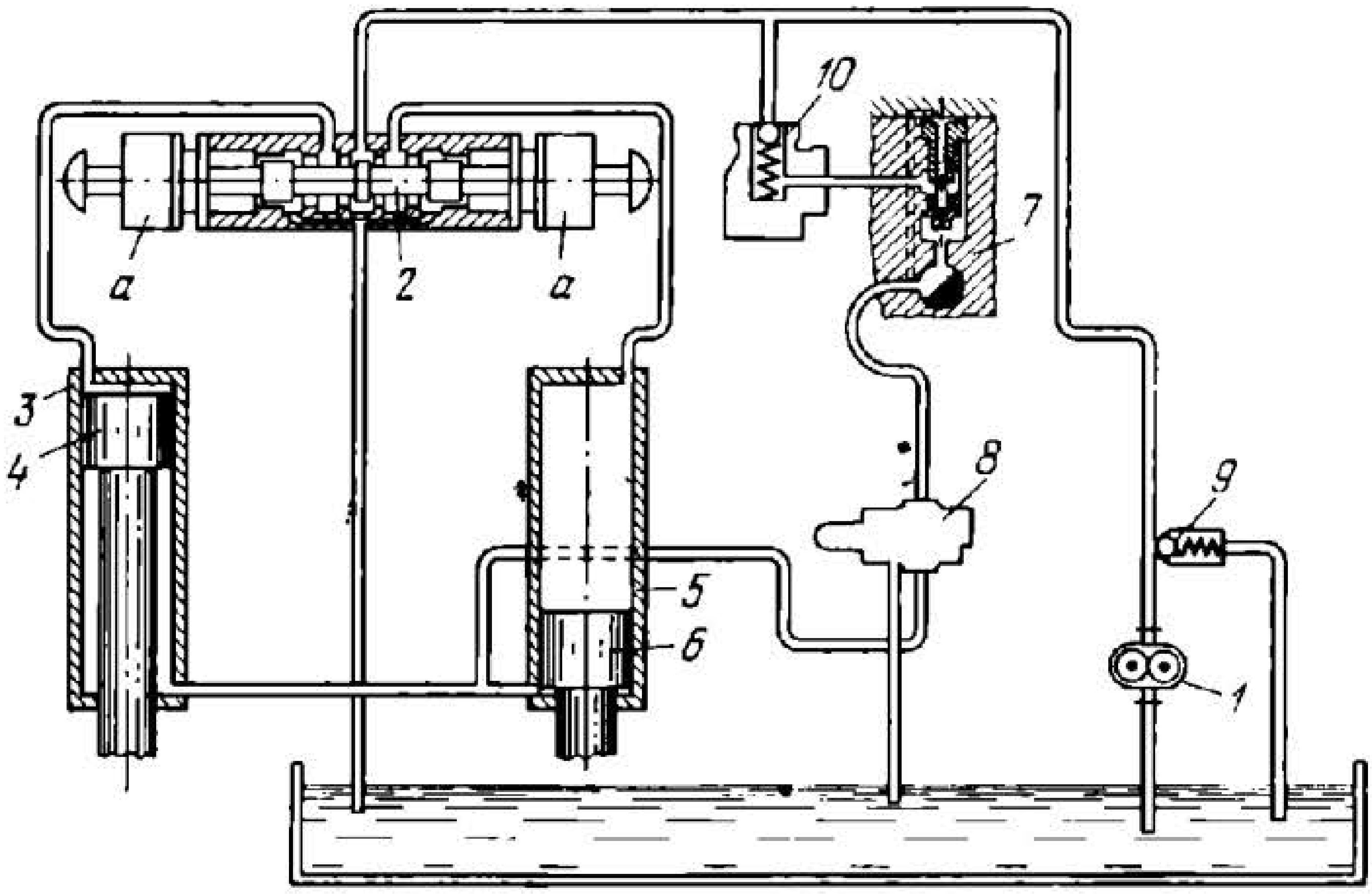
When lever *1* is turned counterclockwise, valve spool *2* is shifted to the right. At this, pump *3* delivers fluid through check valve *11* to the upper end of power cylinder *4*, moving piston *5*, to which roller *6* and member *7* are linked, downward. This turns lever *8* about fixed axis *A*, clamping work *9*. Fluid from the lower end of cylinder *4* is discharged through the directional valve to the tank. Relief valve *10* maintains the required fluid pressure in the system. To release the work, spool *2* is shifted to the left by lever *1*, admitting fluid to the lower end of cylinder *4*.

4286	HYDRAULIC MULTIPLE CLAMPING MECHANISM	CHP GC

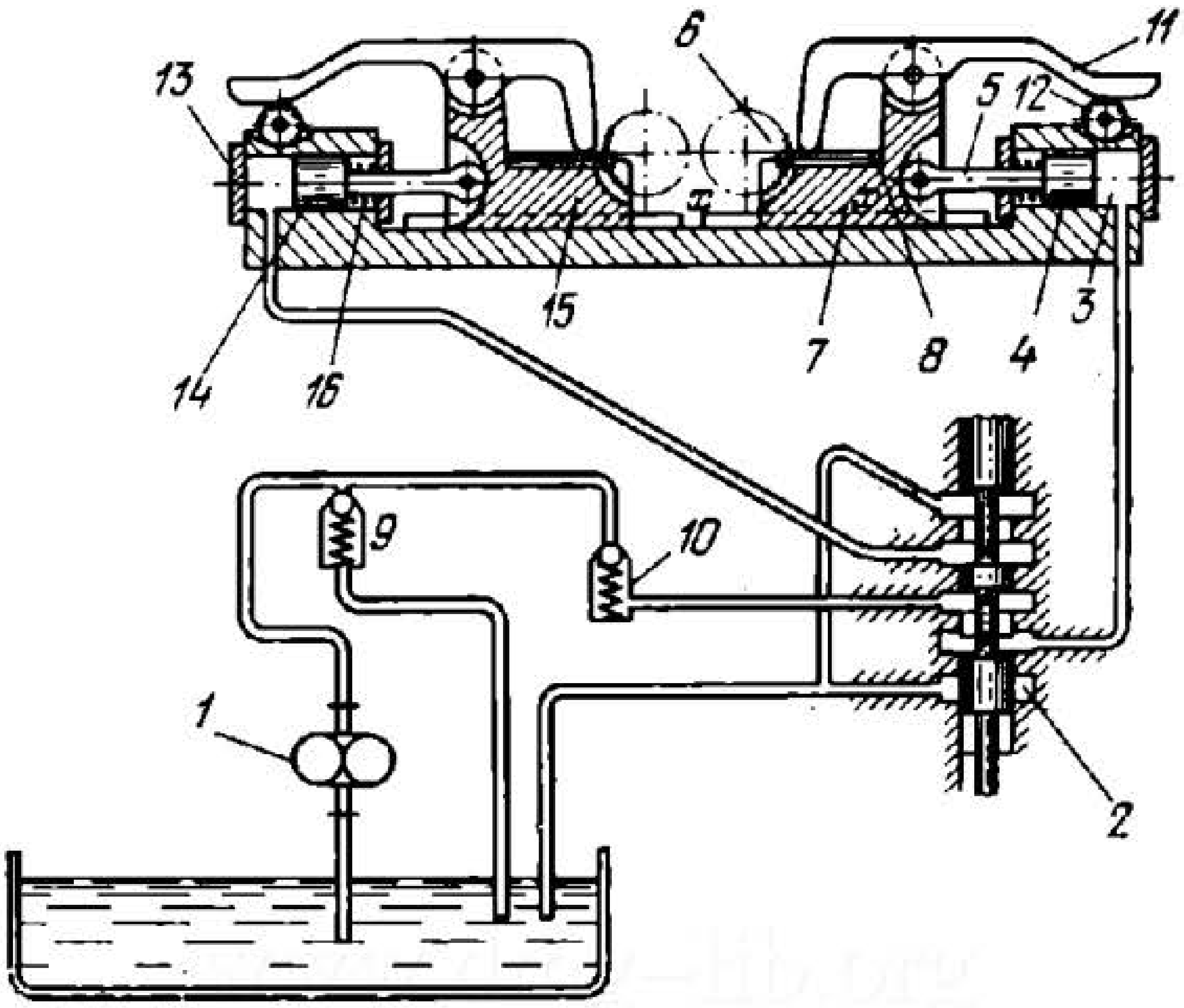


When lever *1* is turned counterclockwise, valve spool *2* is shifted to the right. At this, pump *3* delivers fluid through check valve *11* and the directional valve to the upper ends of power cylinders *4*, moving pistons *5*, to which rollers *6* and members *7* are linked, downward. This turns levers *8* about fixed axes *A*, clamping workpieces *9*. Fluid from the lower ends of cylinders *4* is discharged through the directional valve to the tank. Relief valve *10* maintains the required fluid pressure in the system. To release the workpieces, spool *2* is shifted to the left by lever *1*, admitting fluid to the lower ends of cylinders *4*.

4287	HYDRAULIC CLAMPING AND FEEDING MECHANISM FOR ALTERNATE RECIPROCAL MACHINING FIXTURES	CHP GC

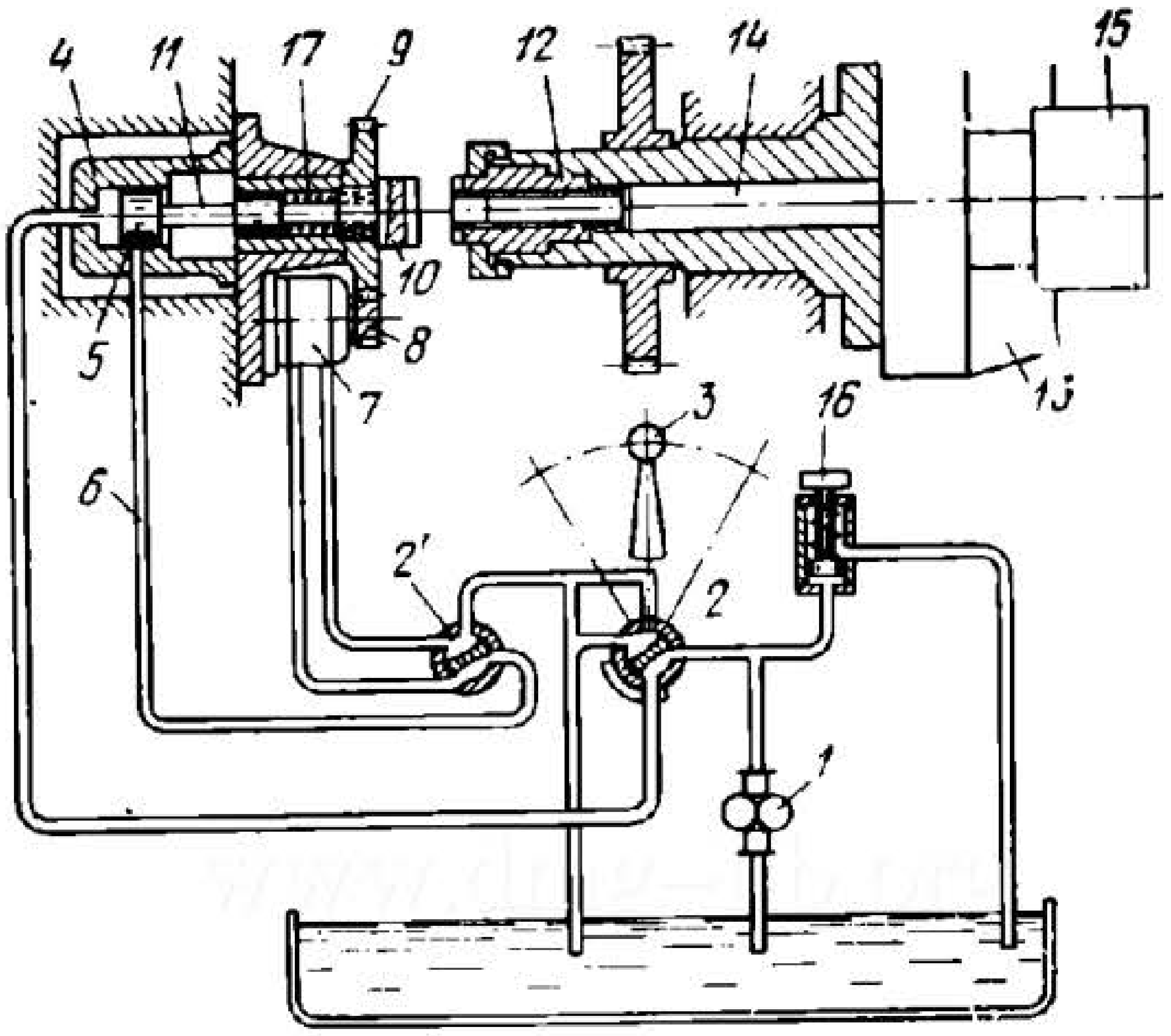


When valve spool *2* is shifted to the right, pump *1* delivers fluid to the upper end of power cylinder *3* whose piston *4* is linked to the work clamping and feeding fixtures (not shown). In its downward working stroke, piston *4* clamps the work and advances and feeds it to the cutting tool. Fluid from the lower end of cylinder *3* is delivered to the lower end of cylinder *5*. This moves piston *6* upward, releasing the finished work from the fixture (not shown) and returning the fixture to the initial position. To obtain a rapid return stroke, speed regulator *7* is turned on and fluid from it is delivered to the lower end of cylinder *5*. Thus, the upward return stroke of piston *6* is faster than the downward working stroke of piston *4*. As soon as piston *6* reaches its upper extreme position, the increased pressure operates valve *8*, which connects the lower end of cylinder *5* to the tank. Valve spool *2* is shifted over during table travel by trip dogs which energize solenoids *a* of the valve. Check valve *10* prevents the fluid from being discharged during operation. Relief valve *9* maintains the required fluid pressure in the system. After spool *2* is shifted to the left, the cycle is repeated in the opposite order. The delivery line is connected to the upper end of cylinder *5* and its piston operates the fixture that clamps the work and feeds it to the cutting tool. Fluid from the lower end of cylinder *5* is delivered to the lower end of cylinder *3*, to which fluid is also delivered from the speed regulator. Piston *4* moves rapidly upward, releasing the finished work and returning the fixture to the initial position.



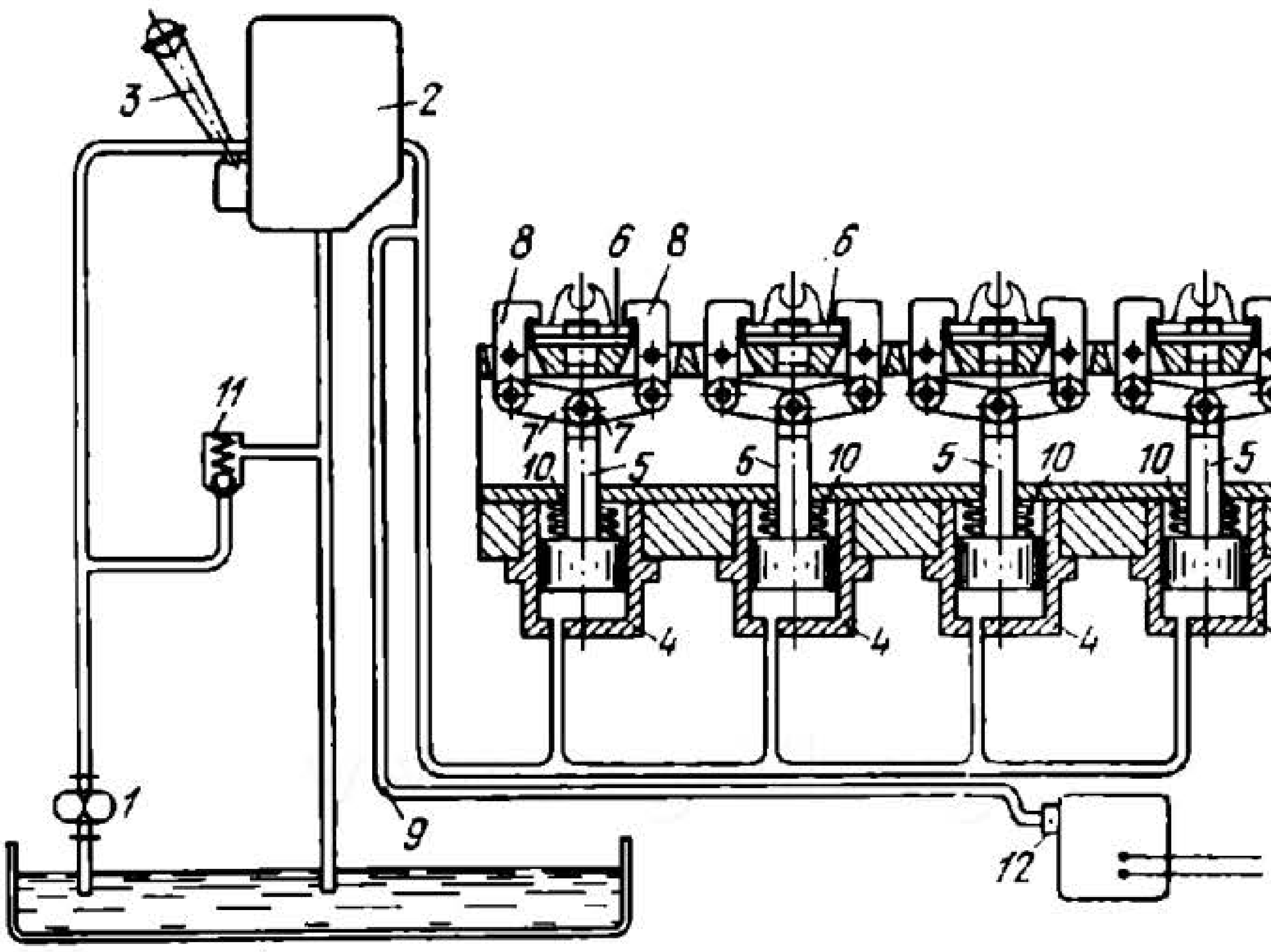
Pump *1* delivers fluid through four-way valve *2* to the right end of working cylinder *3*. The pressure of the fluid moves piston *4* and rod *5* to the left, advancing fixture *7*, sliding in guides *x-x* together with clamped work *8*, to milling cutter *6*. The work is clamped by lever *11*, whose shank runs onto roller *12* when fixture *7* is advanced. The left end of cylinder *13* is connected to the tank and piston *14*, together with fixture *15*, is moved by heavy spring *16* to the initial position to remove the milled workpieces and load new blanks. Check valve *10* prevents the fluid from being discharged during operation. Relief valve *9* maintains the required fluid pressure in the system. In the lower position of the valve spool, the delivery line of pump *1* is connected to the left end of working cylinder *13*, performing the milling operation with the left-hand fixture. The right end of cylinder *3* is connected to the tank, retracting the right-hand fixture to remove the milled workpieces and to load new blanks.

4289	ROTARY HYDRAULIC CLAMPING FIXTURE MECHANISM	CHP GC



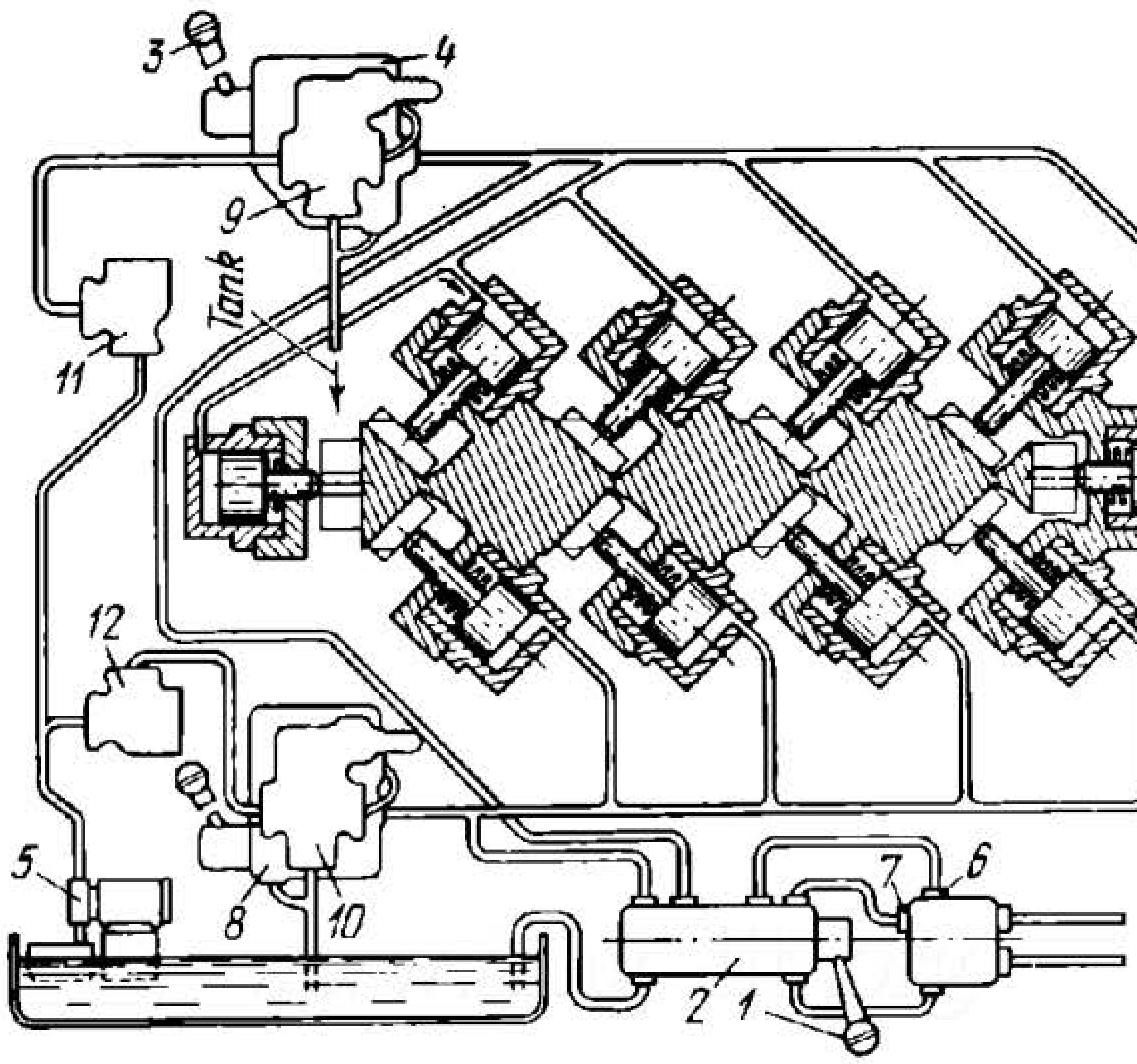
With rotary directional valves *2* and *2'* turned to the corresponding position by lever *3*, pump *1* delivers fluid to cylinder *4*. At this, the fluid moves piston *5* to the right opening the port to pipeline *6* and fluid is delivered through pipeline *6* and valve *2'* to hydraulic motor *7*. Rotation of the motor is transmitted through gears *8* and *9* to clutch member *10*, which is linked to piston rod *11* and can move axially with respect to the gears. Upon further motion of piston *5* to the right, member *10* engages nut *12*. Upon rotation of nut *12*, jaws *13*, linked to the nut through threaded draw-bar *14*, move inward to clamp work *15*. Relief valve *16* regulates the fluid pressure in the system. When valve *2* is turned, pump *1* discharges fluid to the tank. At this, spring *17* disengages clutch member *10*.

4290	HYDRAULIC MECHANISM OF A MULTIPLE CLAMPING FIXTURE	CHP GC



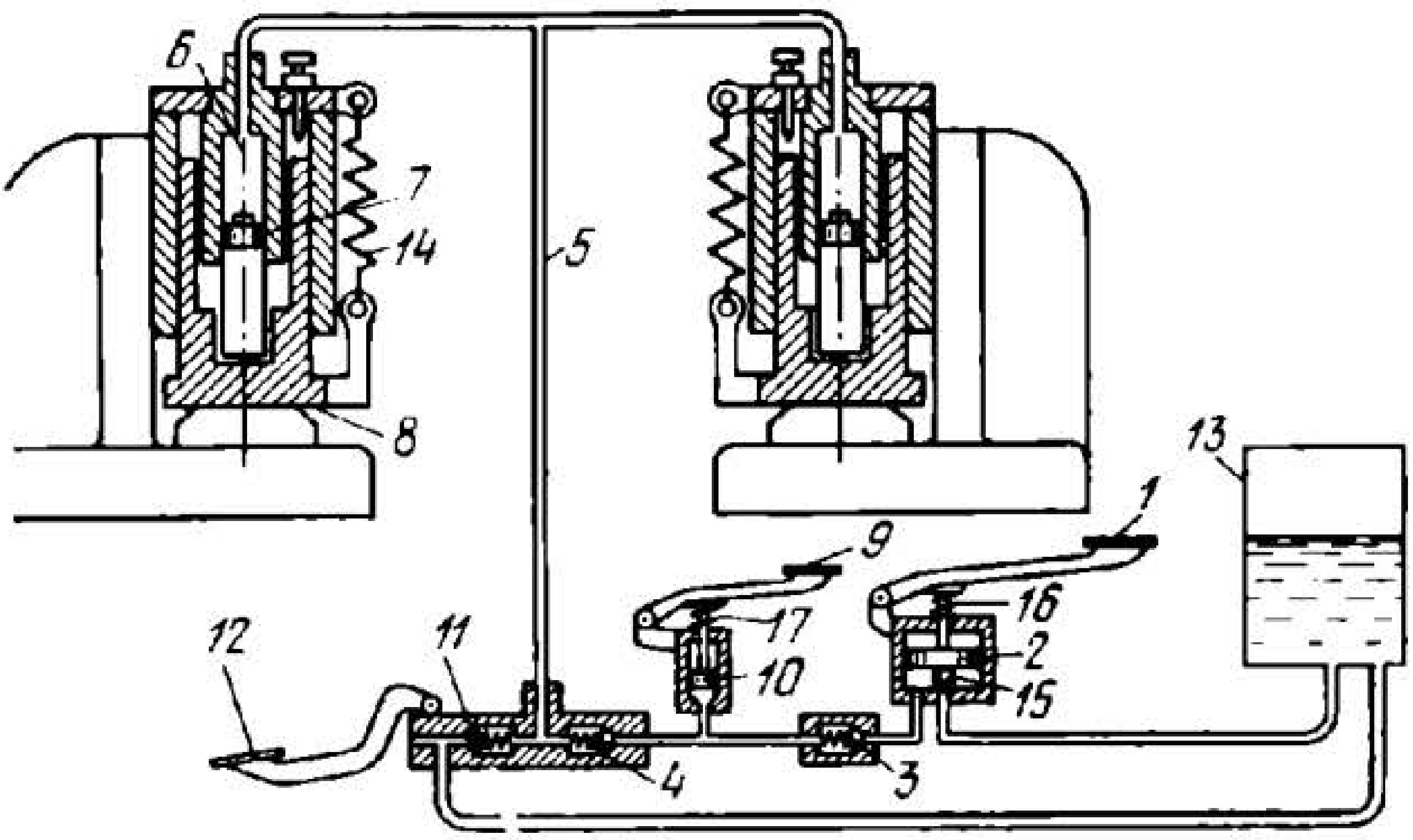
Pump *1* delivers fluid through valve *2*, controlled by lever *3*, to the lower ends of cylinders *4*. The pressure of the fluid moves the pistons and their rods *5* upward, clamping workpieces *6* by means of levers *7* and *8*. At this, the pressure increases in pipeline *9* and actuates button *12* which switches on the feed of the machine tool. At the end of the machining operation, lever *3* is turned so that pump *1* discharges fluid to the tank. The pressure in pipeline *9* and in cylinders *4* drops, and piston rods *5* are returned by springs *10* to the initial position. Fluid from cylinders *4* is discharged to the tank and the workpieces are released. Upon a drop in pressure in pipeline *9*, button *12* is returned to its initial position, switching off the feed. The system is protected by relief valve *11* against overloads.

4291	HYDRAULIC MECHANISM OF A MULTIPLE CLAMPING FIXTURE	CHP GC



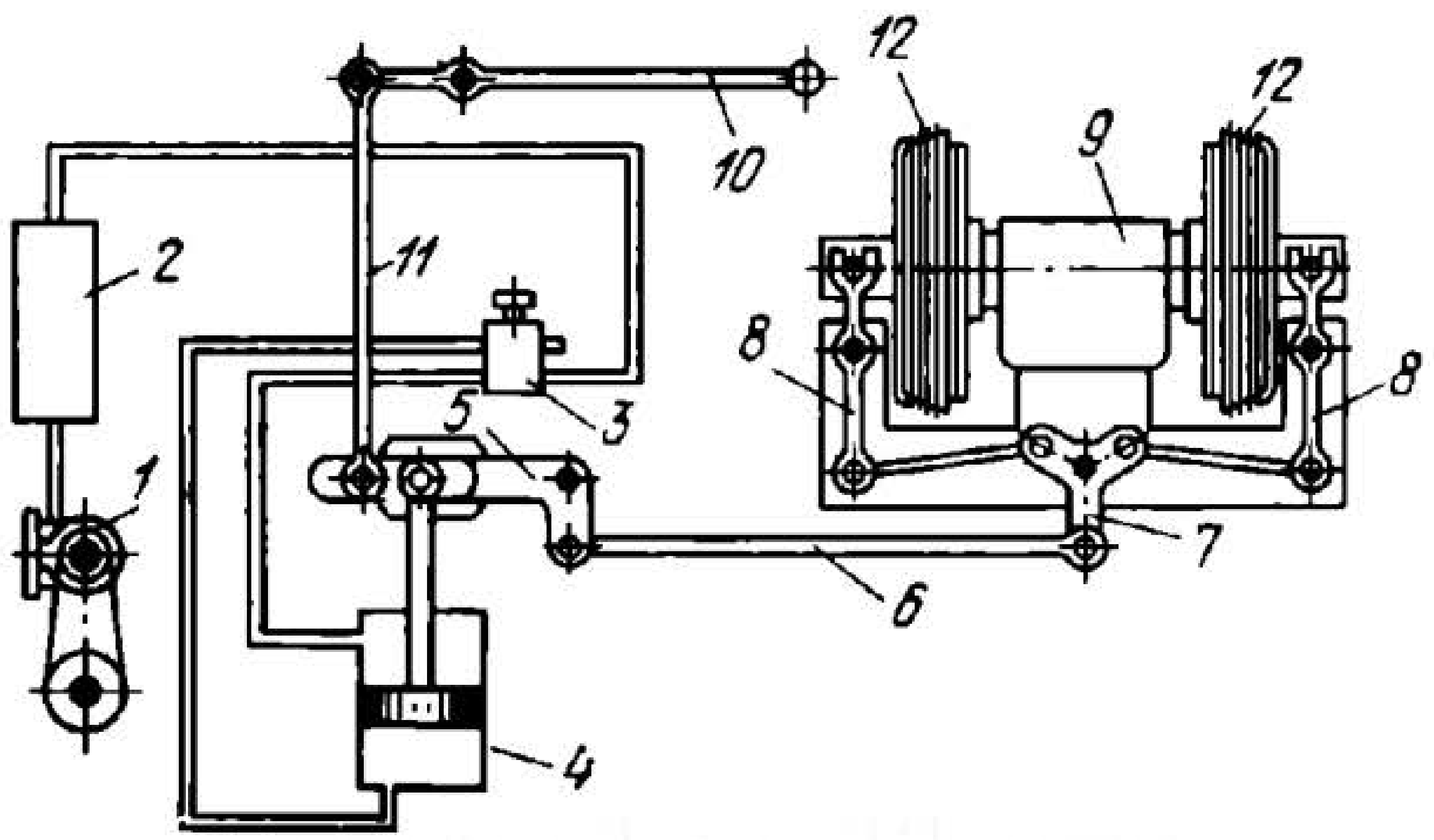
To switch on the first line, operating six cylinders, lever *1* of three-position directional valve *2* is turned, and lever *3* of spool-type directional valve *4* is put into the working position. Fluid is delivered by pump *5* to the six cylinders of the first line, actuating their pistons and clamping the workpieces. After this, the pressure in the first line increases and actuates buttons *6* and *7*, engaging the feed of the machine tool. At the end of the machining operation, lever *3* is turned, pump *5* begins to discharge fluid to the tank, pressure in the first line drops and the feed is disengaged. The pistons of the first line are retracted by springs and the fluid is discharged to the tank. To switch on the second line, operating four cylinders, lever *1* of directional valve *2* is shifted to the second position, and the lever of spool-type directional valve *8* is put into the working position. To switch on both lines, lever *1* is shifted to the third position, and both valves, *4* and *8*, are put into the working position. Relief valves *9* and *10* protect the system against excess pressure. Check valves *11* and *12* prevent the fluid from being discharged during operation.

4292	HYDRAULIC CLAMPING DEVICE MECHANISM OF A BUTT WELDER	CHP GC



When pedal *1* is depressed, piston *2* moves downward and fluid under pressure is delivered through check valves *3* and *4* and pipeline *5* to servomotor *6*. At this, piston *7* moves downward and plunger *8* with a welding die descends onto the contact heads, located on the base of the clamping devices. When pedal *9* is depressed, piston *10*, of smaller diameter than piston *2*, moves downward, delivering fluid through valve *4* and pipeline *5* to servomotor *6*, firmly clamping the components to be welded. Check valve *11* is closed during operation of the clamping devices. To release the components and to raise the welding dies, pedal *12* is depressed. This opens valve *11* and fluid is discharged to tank *13*. The welding dies are raised by springs *14*. Check valve *15* prevents the fluid from being discharged to the tank while pressure is being developed. When pedal *1* is raised by spring *16*, fluid from the tank is drawn in under piston *2*. Check valve *3* is provided to prevent excess pressure in the system for advancing the clamping devices. Check valve *4* prevents a possible reduction in pressure in the system of clamping devices when pedal *9* is released and piston *10* is moved upward by spring *17*.

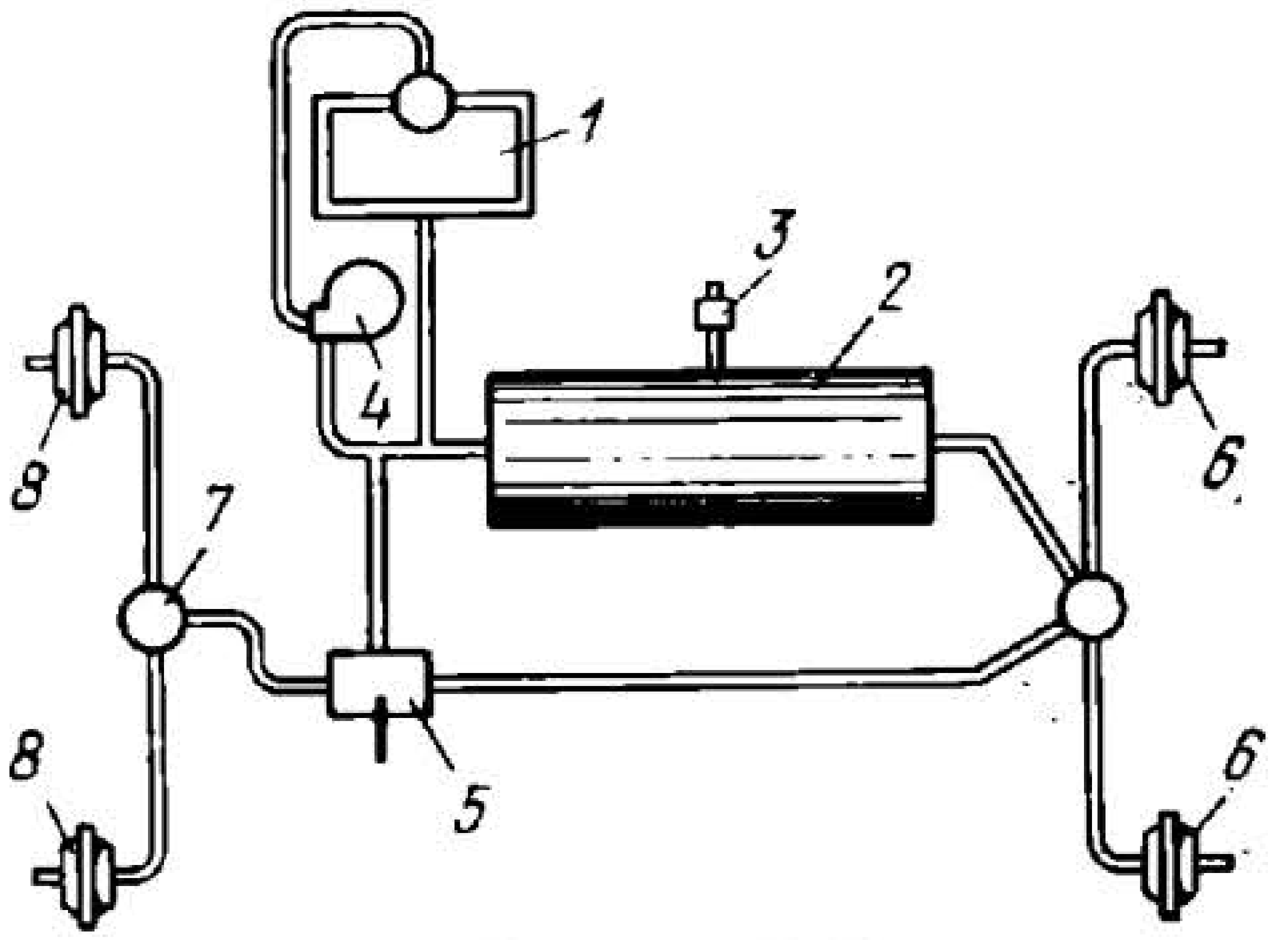
4293	PNEUMATIC DRIVE MECHANISM FOR REVERSING GEAR CLUTCHES	CHP GC



Vacuum pump *1*, powered by a belt drive, creates a vacuum in receiver *2*. By means of directional valve *3*, one of the ends of servomotor *4* is connected to the atmosphere and the other to receiver *2*. Owing to the difference in pressure in the two ends of servomotor *4*, its piston moves in the direction of lower pressure. This motion is transmitted by lever system *5*, *6*, *7* and *8* to engage one of the clutches *12* and disengage the other, thereby operating reversing gear *9*. The reversing gear can be manually operated by turning lever *10*, with its motion transmitted through lever system *11*, *5*, *6*, *7* and *8*.

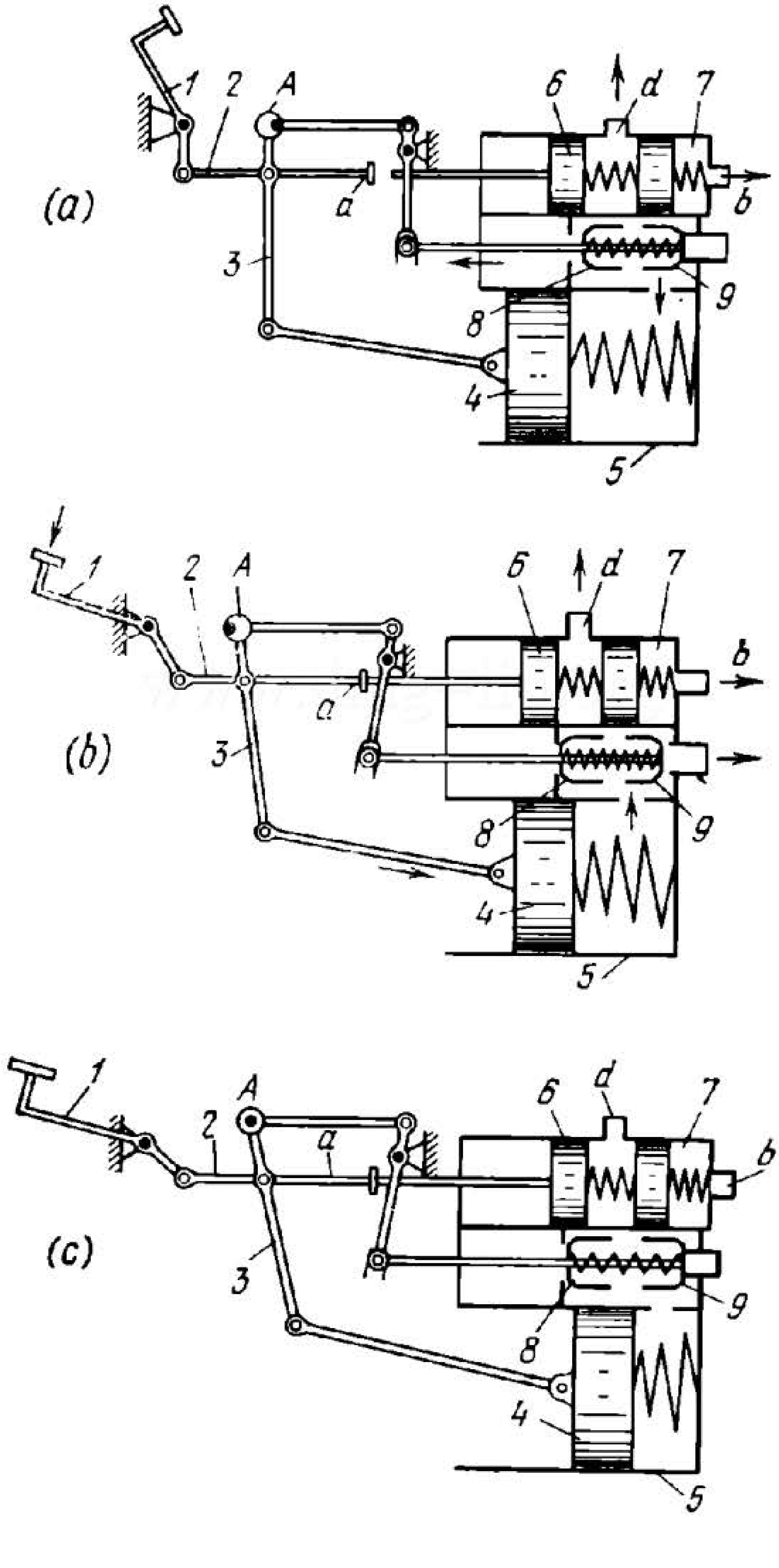
8. BRAKE MECHANISMS (4294 through 4300)

4294	PNEUMATIC BRAKE MECHANISM OF A BUS	CHP Br



Compressor *1* delivers compressed air into tank *2*. Relief valve *3* maintains a constant air pressure in the system. Braking is performed by depressing the pedal of brake valve *5*, connected to the air tank and to brake chambers *6*, which apply the rear wheel brakes. Valve *5* is connected through rapid-release valve *7* to brake chambers *8* of the front wheels. The purpose of rapid-release valve *7* is to discharge the air from the front brake chambers as rapidly as possible to the atmosphere, by-passing brake valve *5*. When the brake pedal is depressed, compressed air from the tank is directed to the brake chambers of the rear and front wheels, braking the bus. When the pedal is released, air from the rear brake chambers is discharged to the atmosphere through brake valve *5*; air from the front brake chambers is discharged to the atmosphere directly through rapid-release valve *7*. Pressure regulator *4* switches the compressor over to idle running.

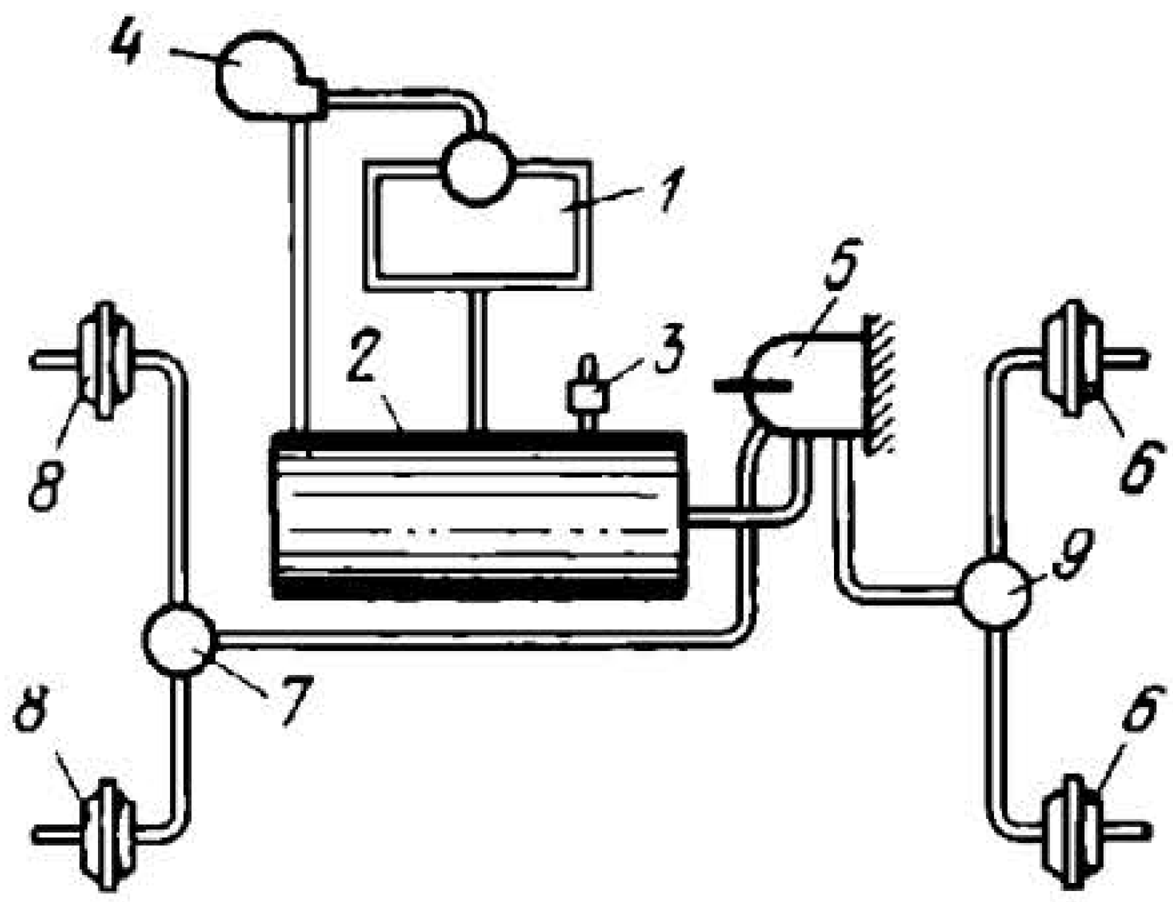
4295	LINKWORK MECHANISM OF HYDROPNEUMATIC AUTOMOBILE BRAKES	CHP Br



LINKWORK MECHANISM OF HYDROPNEUMATIC AUTOMOBILE BRAKES

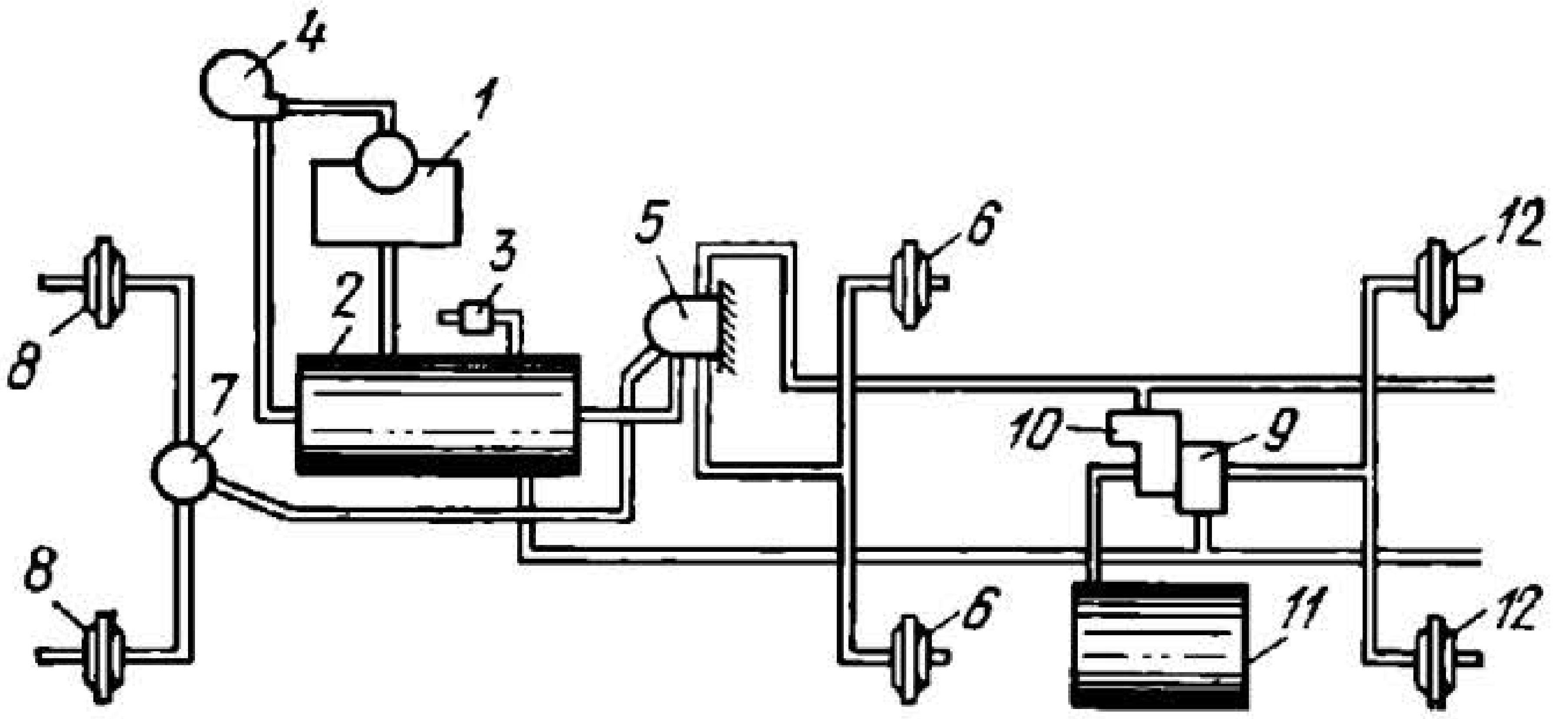
Brake pedal *1* is linked through tie-rod *2* to lever *3*, the upper end of which is loosely fitted, with a large clearance, on pin *A*, and the lower end is linked to piston *4*. Piston *4* reciprocates in vacuum cylinder *5*. The position shown in Fig. *a* is the inoperative state of the mechanism, in which pusher *a* of the pedal does not contact the rod of piston *6* in hydraulic cylinder *7* and valve *8* connects vacuum cylinder *5* to the atmosphere. When pedal *1* is depressed (Fig. *b*), pusher *a* moves piston *6* to the right. At the same time, the upper end of lever *3* is moved to its opposite extreme position and valve *8* is closed. Further depression of pedal *1* produces the working pressure in main hydraulic cylinder *7*, and hydraulic fluid under pressure is delivered through port *d* to the front wheel brakes and through port *b* to the rear wheel brakes. This pressure is intensified by the opening of vacuum valve *9*, connected to the suction line of the engine. As a result, the vacuum is increased in the vacuum pump and piston *4* is moved to the right, turning lever *3* counterclockwise. Holding the pedal at any position maintains a constant braking force, because moving piston *4* of the vacuum cylinder moves the upper end of lever *3* to its central position with respect to pin *A* (see Fig. *c*). This closes both valves and the piston remains in an equilibrium position.

4296	PNEUMATIC BUS BRAKE MECHANISM WITH AN ACCELERATION VALVE	CHP Br

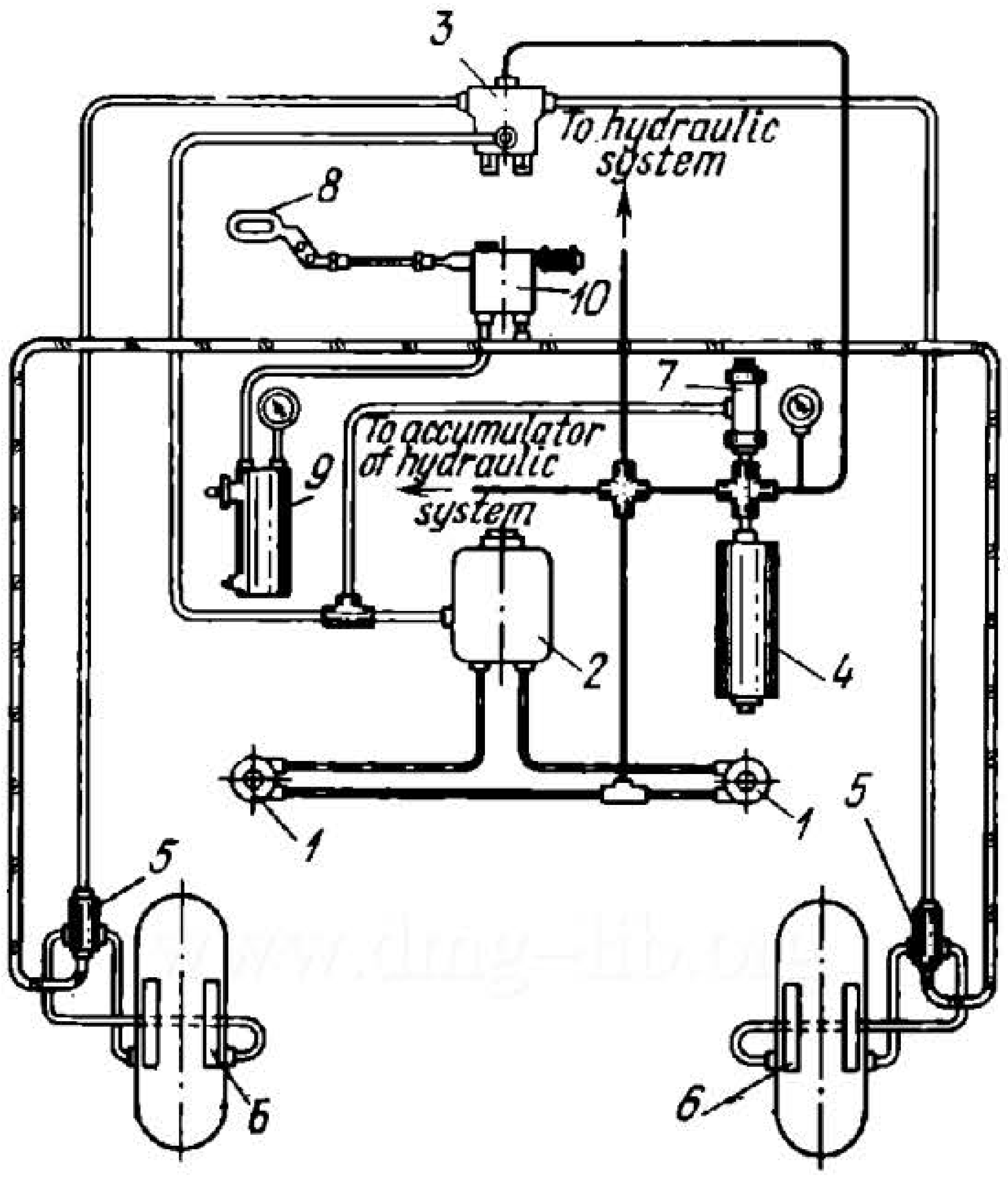


Compressor *1* delivers compressed air into tank *2*. Relief valve *3* maintains a constant air pressure in the system. Braking is performed by depressing the pedal of brake valve *5*, connected to air tank *2*. Valve *5* is connected through rapid-release valve *7* to brake chambers *8* of the front wheels, and through acceleration valve *9* to brake chambers *6* of the rear wheels. In addition, acceleration valve *9* is connected to the air tank. The purpose of rapid-release valve *7* is to discharge the air from the front brake chambers as rapidly as possible to the atmosphere, by-passing brake valve *5*. The provision of acceleration valve *9* shortens the path of the compressed air to the brake chambers. Pressure regulator *4* switches the compressor over to idle running.

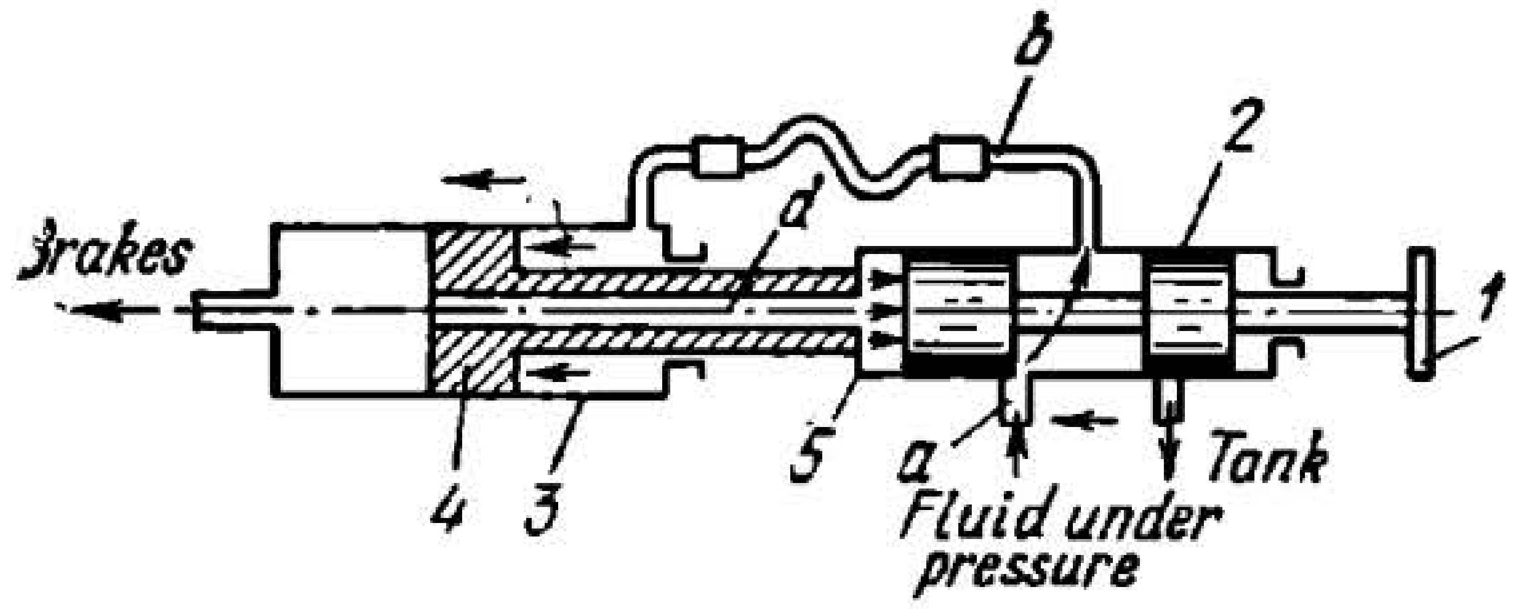
4297	PNEUMATIC BRAKE MECHANISM OF A TRUCK-TRAILER COMBINATION	CHP Br



All the mechanisms controlling the operation of the system and supplying the air are located on the truck tractor. The trailers of the combination are equipped only with the mechanisms for their own braking purposes. Compressor *1* delivers compressed air to tank *2*. Relief valve *3* maintains a constant air pressure in the system. Tank *2* is connected by a pipeline to emergency valves *9* of the trailers. Brake valve *5*, connected to tank *2*, admits compressed air to brake chambers *6* of the rear wheels, through rapid-release valve *7* to brake chambers *8* of the front wheels and to acceleration valves *10* of the trailers. When no braking action is required, compressed air is delivered from the tank through emergency valve *9*, operating in conjunction with acceleration valve *10*, to supplementary tank *11*. When the pedal of brake valve *5* is depressed, compressed air is delivered to the brake chambers of the front and rear wheels of the truck tractor and, simultaneously, to acceleration valves *10* of the trailers. Acceleration valves *10* admit air from supplementary tank *11* and main tank *2* to brake chambers *12* of the trailers. The whole truck-trailer combination is braked simultaneously. Air is discharged from brake chambers *12* of the trailers, when the brakes are to be released, through acceleration valves *10*. Air is discharged from the rear brake chambers of the truck tractor through brake valve *5*; air from the front brake chambers is discharged to the atmosphere through rapid-release valve *7*. Pressure regulator *4* switches the compressor over to idle running. If trailers break away from the combination, the pipeline leading to the acceleration and emergency valve is ruptured, cutting off the air supply from the truck tractor. Then the trailers are braked by the reserve air from supplementary tank *11*, which passes through the acceleration and emergency valves to the brake chambers, performing the braking operation.

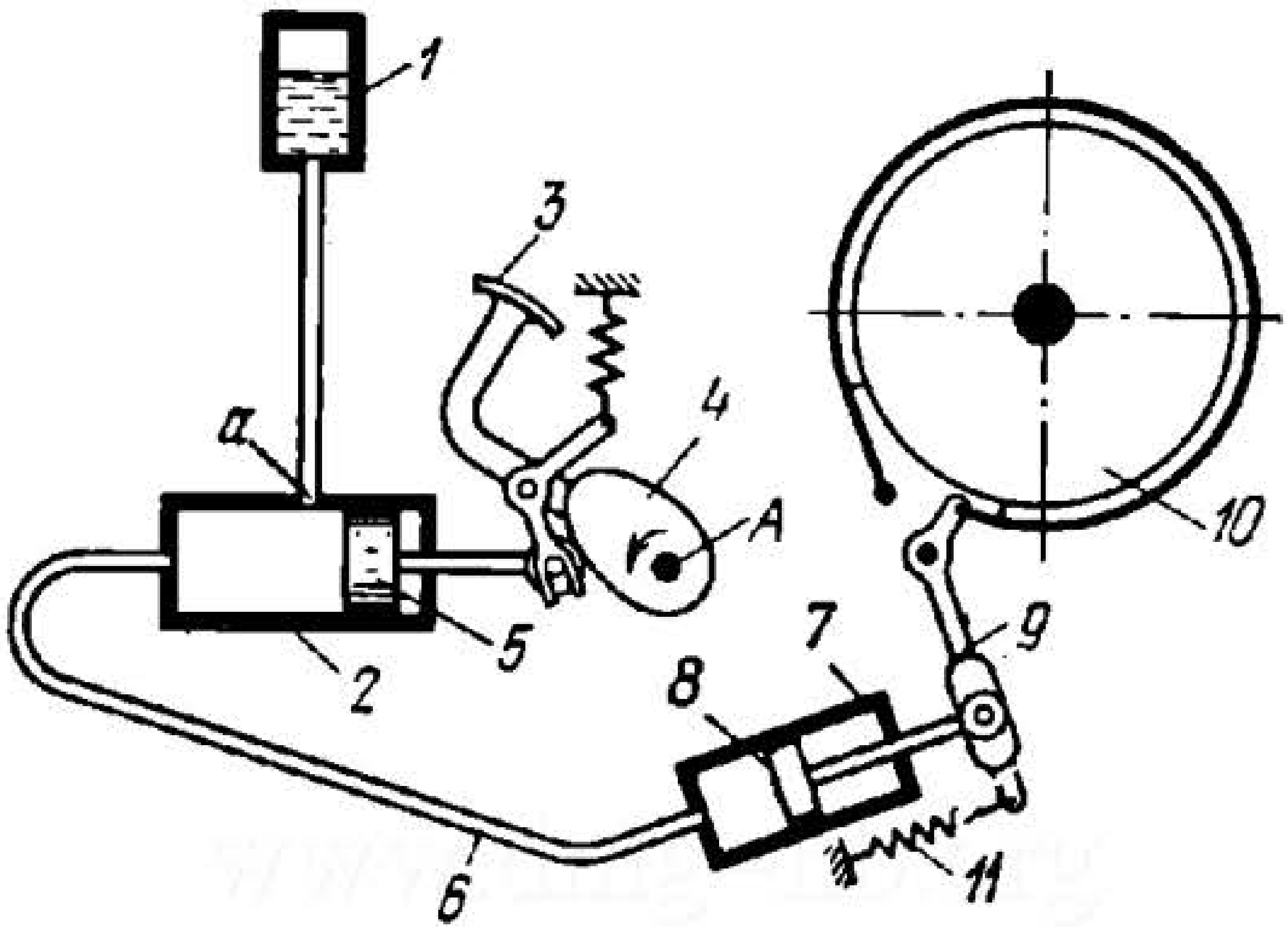


Pumps *1* deliver hydraulic fluid from tank *2* to the hydraulic system and to pressure accumulator *4*. Under normal braking operation, the brakes are applied by means of valve *3*. When the brake pedal is depressed, fluid from the main hydraulic system of the plane or from accumulator *4* is delivered through valve *3* and switchover valves *5* to disk brakes *6*, braking the wheels. The system provides for braking both wheels at once or for braking the right and left wheels separately. When the brakes are released, the fluid is discharged from the cylinders of brakes *6* through valve *3* back to tank *2*. Accumulator *4* has relief valve 7. Valve *3* consists of two identical units in a single housing. In addition to the hydraulic system, the brakes can also be operated by an independent emergency pneumatic system. When lever *8* is turned, compressed air from tank *9* passes through valve *10* to switchover valves *5*, which switch off the hydraulic mains and admit the air to the cylinders of brakes *6*, performing the braking operation. When the brakes are released, the air is discharged through the same pipelines and valve *10* to the atmosphere.



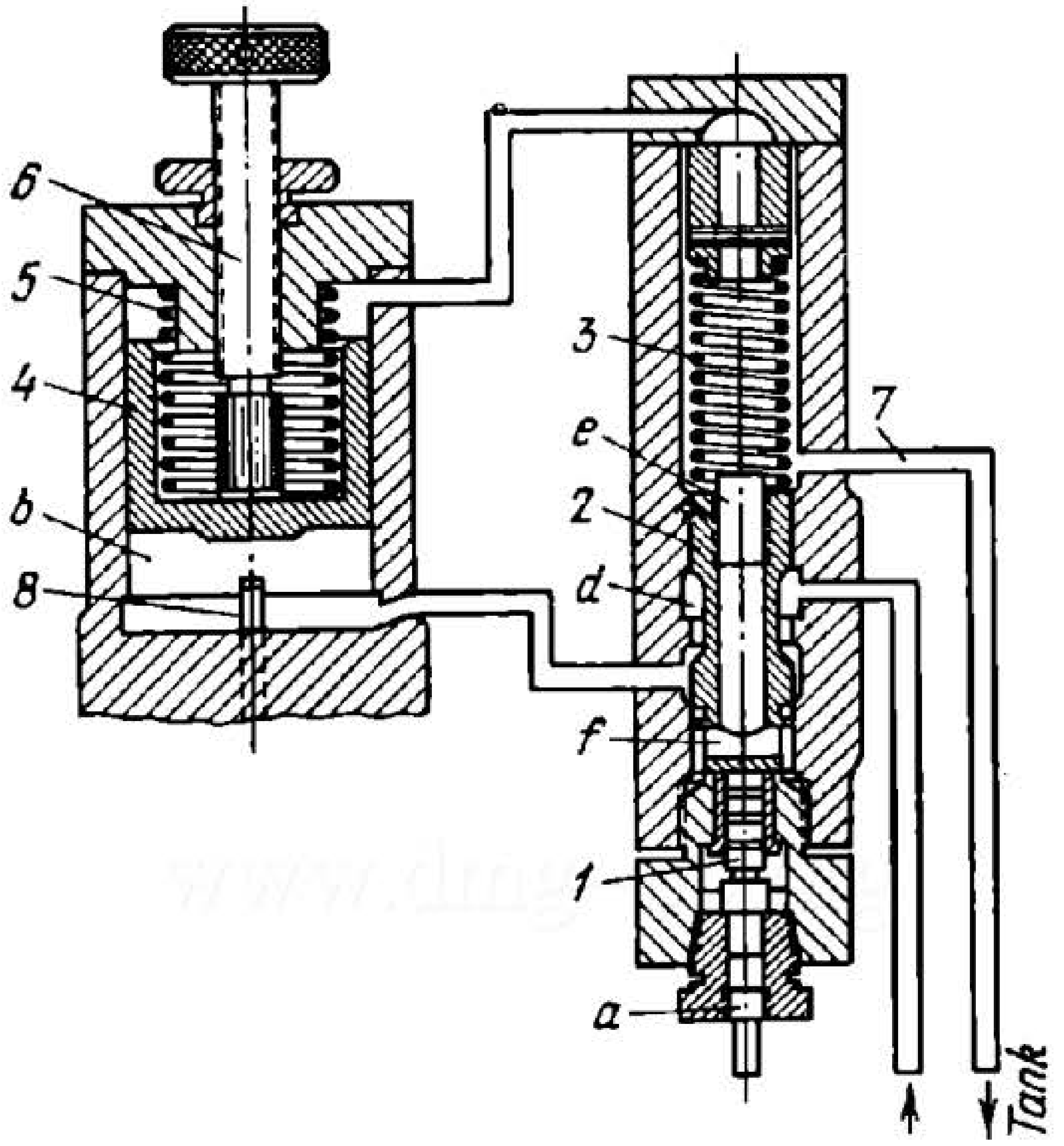
When pedal *1* is depressed, valve spool *2* is shifted to the left and hydraulic fluid under pressure, delivered through port *a*, passes through passage *b* to the right end of cylinder *3*. This moves piston *4* to the left. Fluid from the left end of cylinder *3* is delivered to the brake cylinders, performing the braking operation. The rod of piston *4* is linked to body *5* of the valve. As piston *4* travels, it moves valve body *5* to the left. When pedal *1* is released, body *5*, in its motion, blocks off port *a* and stops fluid delivery to cylinder *3*. Piston *4* stops moving. The left end of cylinder *3* is connected by axial passage *d* to the left end of body *5*. The working pressure of the fluid in the left end of cylinder *3* resists motion of valve spool *2* with a force proportional to the degree of braking action. When pedal *1* is released, valve spool *2* is shifted to the right by the fluid pressure and connects passage *b* to the tank. This enables piston *4* to move to the right.
At this, the brakes of the wheels are released.

HYDRAULIC DRIVE MECHANISM OF A BAND BRAKE



Hydraulic fluid from tank *1* flows by gravity into pressure cylinder *2*. When brake pedal *3* is depressed, cam *4* turns about fixed axis *A* and moves piston *5* to the left. Fluid forced out of the left end of cylinder *2* by piston *5* is delivered through pipeline *6* to operating cylinder *7*, moving piston *8* to the right. Through lever *9*, this applies tension to the brake band which brakes drum *10*. When pedal *3* is released, spring *11* returns lever *9* and piston *8* to the initial position. Fluid from cylinder *7* is returned to pressure cylinder *2*, returning piston *5* and pedal *3*. Leakage of fluid from the system is automatically replenished by the flow of fluid from the tank through port *a*.

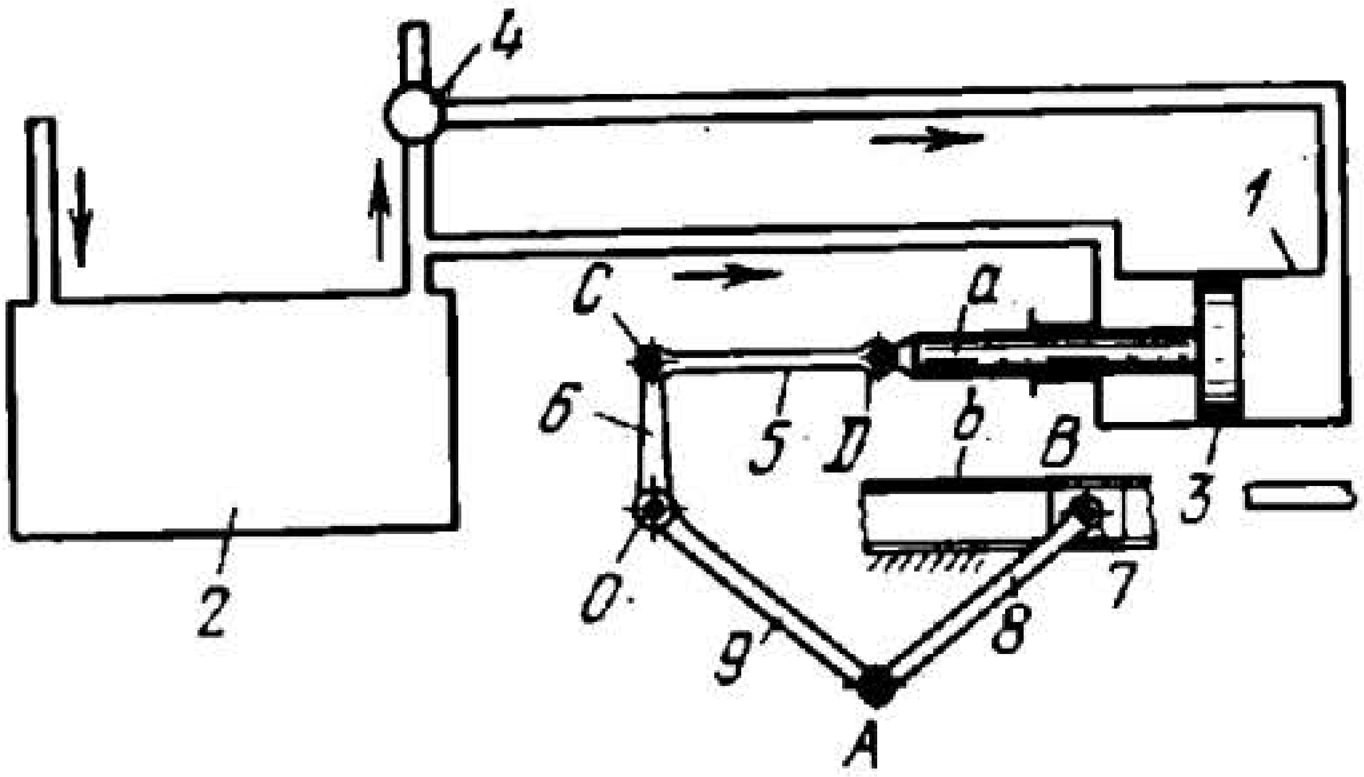
4301	TIME RELAY AND PRESSURE RELAY MECHANISM	CHP Re



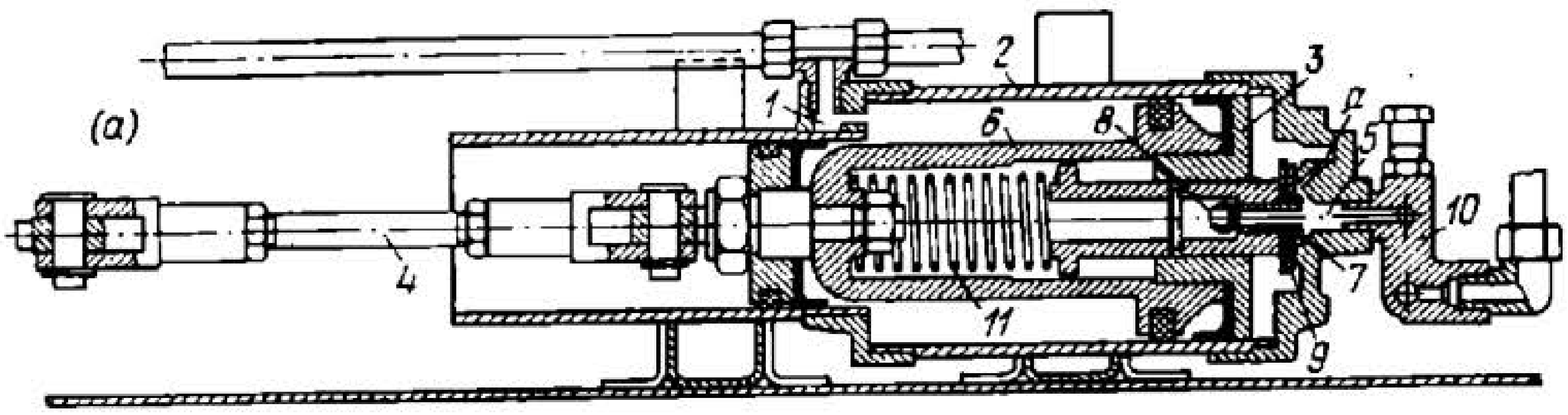
Port *a* of the pressure relay is connected to the delivery line so that plunger *1* exerts a force on plunger *2*, which is subject to the action of spring *3*. Chamber *d* of the pressure relay is connected to a line of constant pressure, maintained by a relief valve. In the position shown, chamber *b* and plunger *4* of the time relay are subject to constant pressure, because chambers *d* and *b* are connected together. Plunger *4* of the time relay, in its upper position, compresses spring *5* and contacts stop *6*. If the pressure in the delivery line increases, plungers *1* and *2* are raised, chamber *b* of the time relay is connected through holes *f* and *e* in plunger *2* and pipeline *7* to the tank. Plunger *4* is moved downward by spring *5* and presses pin *8*, which transmits a signal to the actuating mechanism. Adjustment of stop *6* sets the stroke of plunger *4* and, consequently, the required time delay.

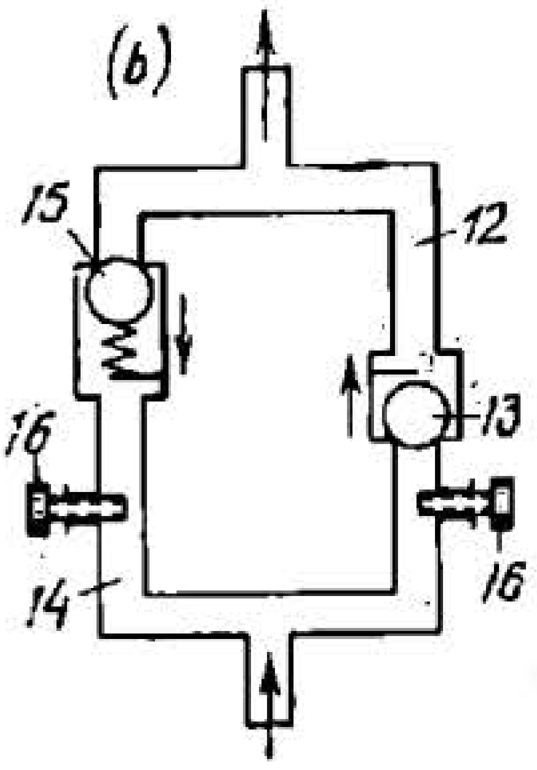
10. MECHANISMS OF OTHER FUNCTIONAL DEVICES (4302 through 4310)

4302	PNEUMATIC BUS DOOR OPENING MECHANISM	CHP FD



The door consists of two equal wings *8* and *9*. Wing *8* is connected by turning pair *B* to slider *7*, which reciprocates along fixed guides *b*. Wing *9* turns about fixed axis *O* and is connected by turning pair *A* to wing *8*. Rigidly secured to wing *9* is lever *6*, which is connected by turning pair *C* to link *5*. Link *5* is connected by turning pair *D* to rod *a* of piston *3*. The left end of cylinder *1* is constantly connected to air tank *2* so that piston *3* is held by compressed air in its extreme right-hand position in which the door is fully open. At this, three-way valve *4* connects the right end of cylinder *1* to the atmosphere. When the handle of valve *4* is turned, the right end of cylinder *1* is connected to air tank *2*. The difference in effective areas on the sides of piston *3* moves it to the left, closing the bus door and holding it in the closed position.



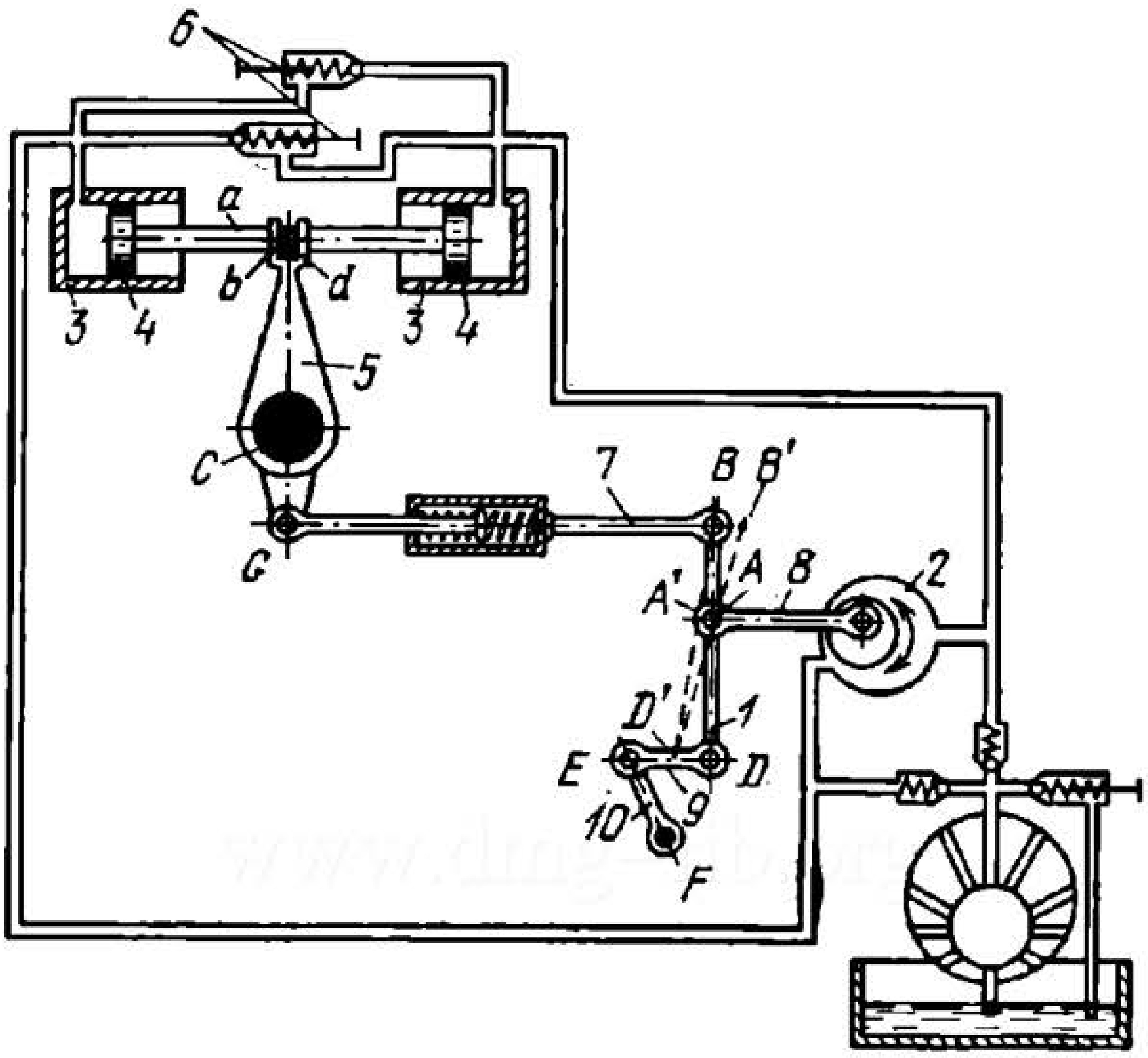


Compressed air from the tank is delivered through port 1 into cylinder 2 (see Fig. *a*) whose piston 3 is linked by tie-rod 4 to a lever mounted on the door. When compressed air is admitted by the door control valve to the right end of cylinder 2 through port 5, piston 3 is moved to its extreme left-hand position in which the door is closed. When the air is discharged from the right end of cylinder 2 through the door control valve, piston 3 is moved to its extreme right-hand position in which the door is open. Air admitted into the cylinder is divided into three streams. The first is admitted into the space in sleeve 6 through plug 7. When the air in the sleeve reaches a certain pressure, greater than in front of the plug, ball 8 closes the opening. This air cannot do any work because its pressure is the same in all directions on the cylinder walls. The second stream passes through channel *a* and applies pressure to piston 3. This pressure is negligible because of the small diameter of the channel. The third stream applies pressure to ring 9 and, compressing spring 11, is gradually admitted into the cylinder. As a result, the motion of the door begins slowly and gradually increases in speed. To regulate the speed of door motion, air is delivered from the control valve, not directly into the cylinder, but through special head 10, whose design is shown schematically in Fig. *b*. Admission of air from the valve to the cylinder is only along channel 12 through check valve 13 and air discharge is only along channel 14 through check valve 15. By means of regulating screws 16, which change the clear opening of the channels in the head, the velocity of air passage through the channels can be varied, thereby varying the speeds of door opening and closing independently of each other.

4304

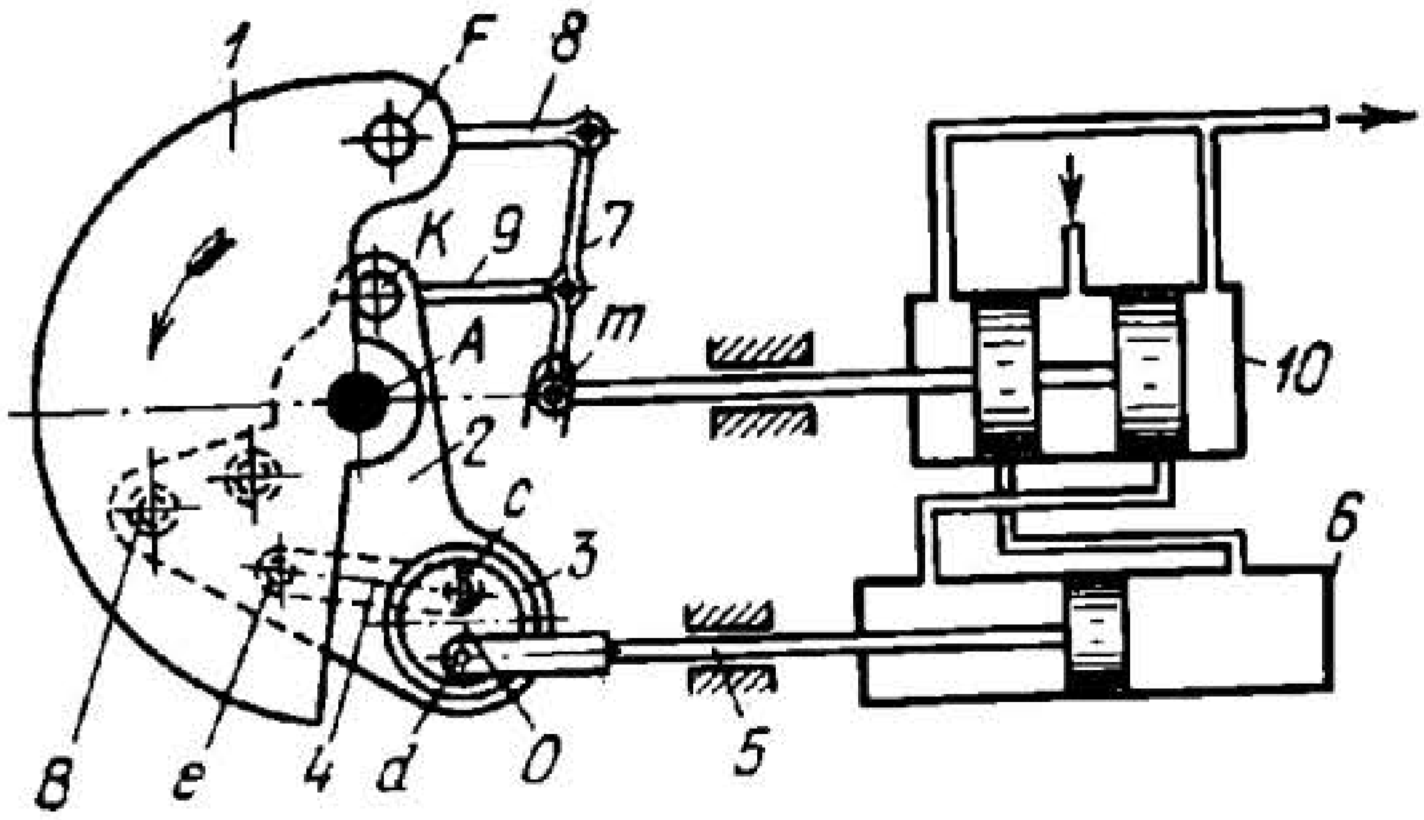
HYDRAULIC LINKWORK MECHANISM OF A SHIP'S RUDDER STOCK

CHP FD



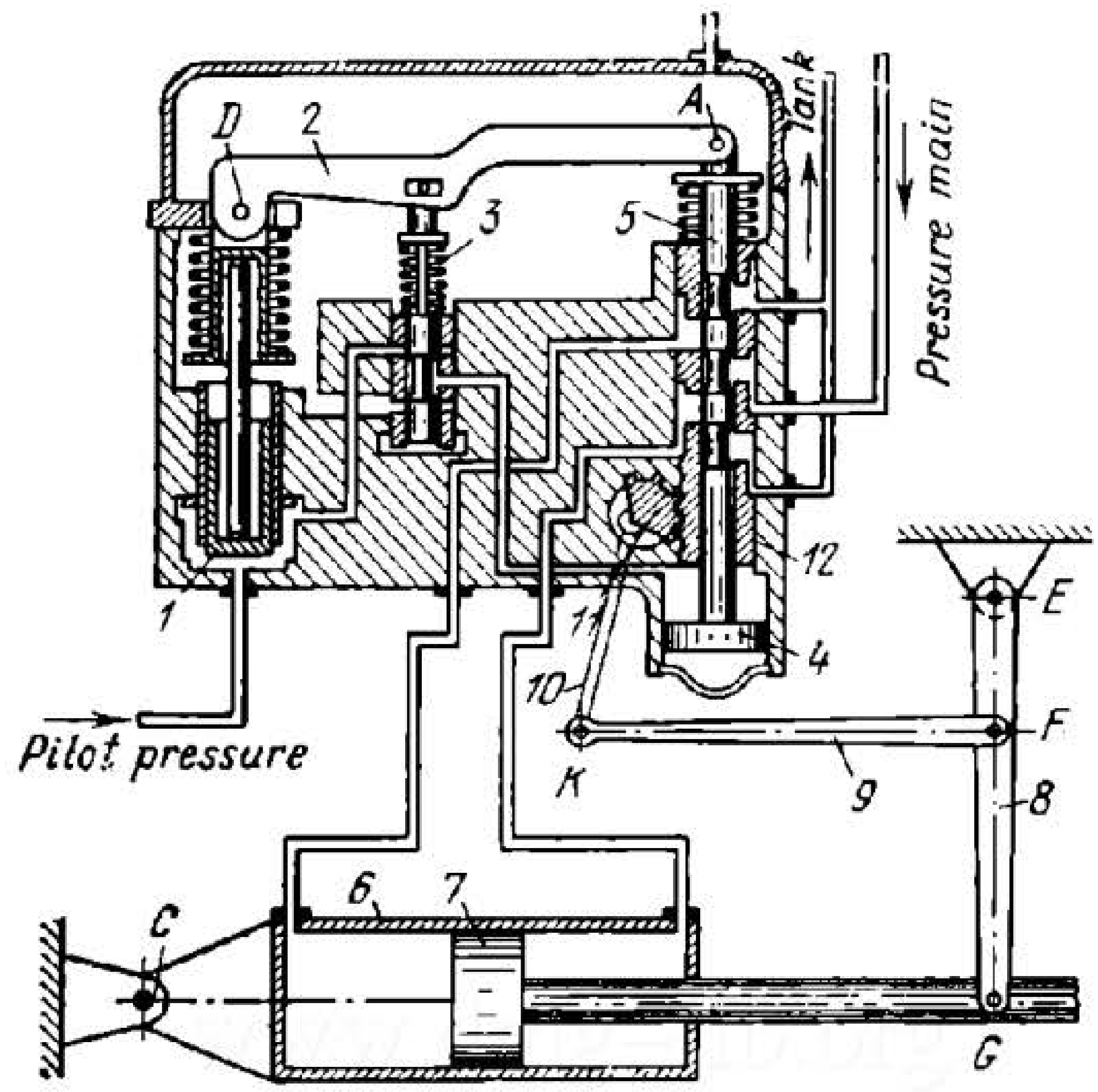
Lever *1* is connected by turning pairs *A*, *D* and *B* to lever *8* for controlling reversible pump *2*, to link *9* and to feedback link *7*. Link *9* is connected by turning pair *E* to lever *10*, turning about fixed axis *F*. Link *7* is connected by turning pair *G* to rudder stock *5* of the ship. Rod *a* of pistons *4* has pin *b* sliding in slot *d* of the stock. When point *D* is displaced to point *D'* and, consequently, point *A* of control lever *1* of reversible pump *2* to point *A'*, the pump delivers fluid to right-hand working cylinder *3*. The fluid moves piston *4* to the left, turning rudder stock *5* about fixed axis *C*, until point *B* of feedback link *7* reaches point *B'*. At this, point *A* of pump control lever *1* is returned to its initial position at which pump *2* ceases to deliver fluid. If point *D* is displaced in the direction opposite to that mentioned above, fluid is delivered to left-hand cylinder *3* and the rudder stock is turned in the opposite direction. Relief valves *6* protect the working cylinders against excess pressure.

4305	HYDRAULIC AIRCRAFT AILERON TURNING MECHANISM	CHP FD



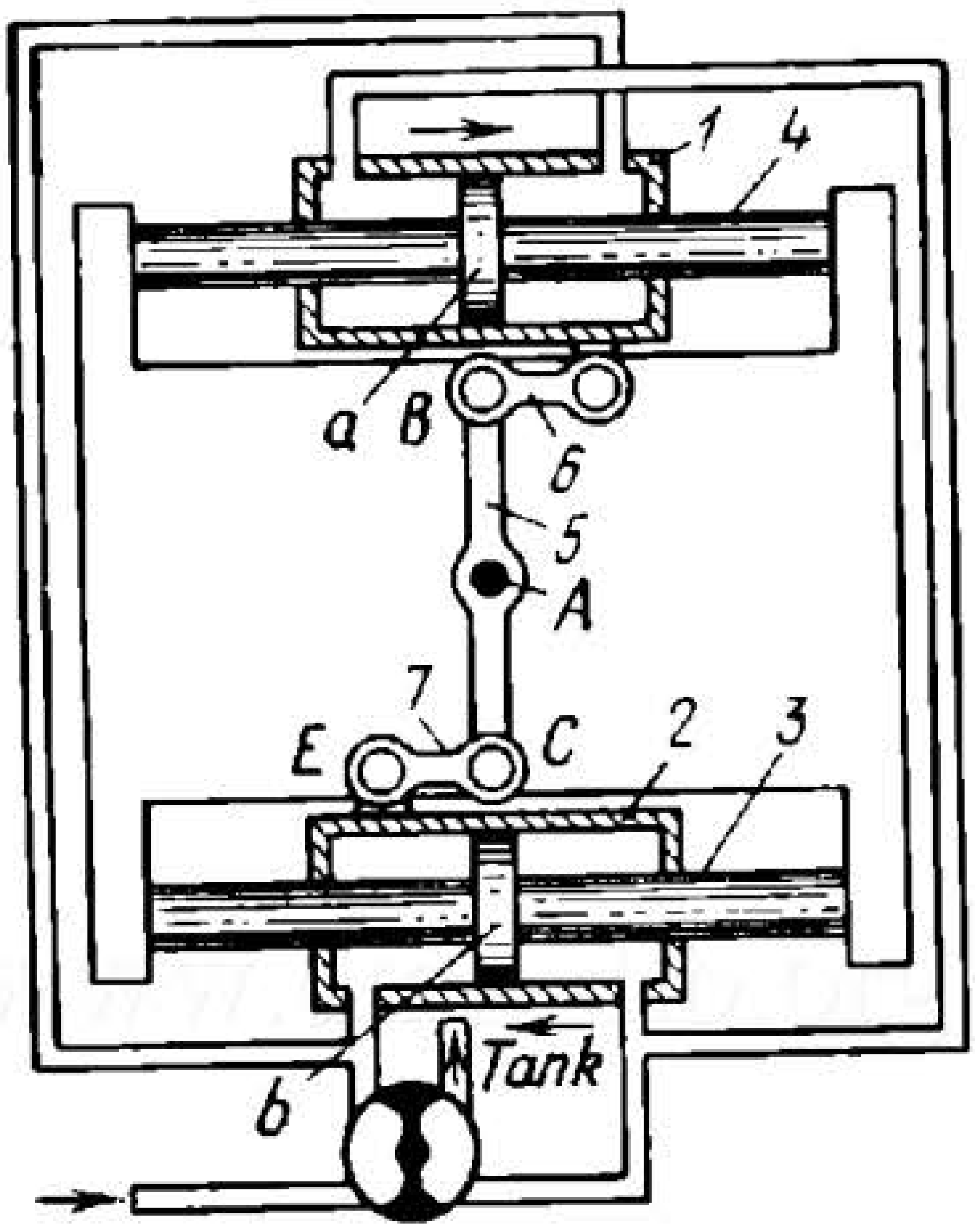
Segment-shaped lever *1*, controlled from the steering wheel in the pilot's cabin, turns freely on fixed axis *A*, as does aileron lever *2*, connected at axis *B* to a tie-rod from the aileron. Mounted in aileron lever *2* is eccentric bearing *3* with two pins, *c* and *d*, located eccentrically with respect to centre *O*. Pin *c* is connected by link *4* to pin *e* in segment-shaped lever *1*. Pin *d* is linked to piston rod *5* of hydraulic servocylinder *6*. Through tie-rod *8*, axis *F* of segment-shaped lever *1* is linked to lever *7*, which is linked, through tie-rod *9*, to point *K* of aileron lever *2*. Fork *m* of lever *7* engages a pin on the stem of the spool in directional valve *10*, which controls fluid delivery to servocylinder *6*. When segment-shaped lever *1* is turned, its motion is transmitted through link *4* and pin *c* to turn bearing *3*. The segment-shaped and aileron levers (and, correspondingly, points *F* and *K*) are displaced with respect to each other, and lever *7* shifts the spool of valve *10*. This directs fluid to servocylinder *6*, moving the piston and piston rod *5*, so that bearing *3* begins to turn in the opposite direction. Turning of the aileron lever operates the ailerons, the force required to turn the control lever being considerably less than if the segment-shaped and aileron levers were rigidly attached to each other.

HYDRAULIC MECHANISM FOR OPERATING AIRCRAFT FLAPS



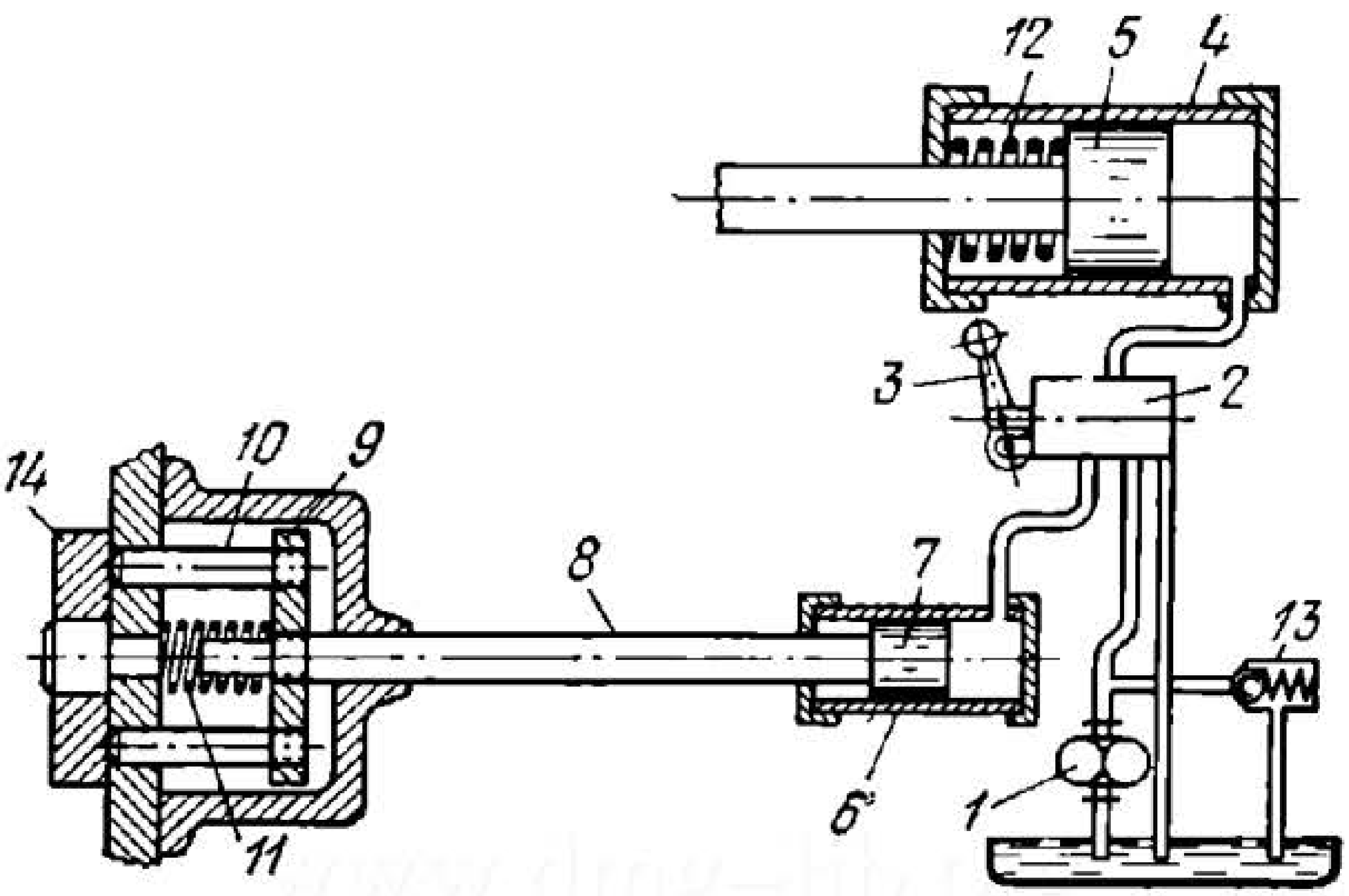
Power cylinder *6* turns about fixed axis *C* and has piston *7*, connected by turning pair *G* to lever *8*, which turns about fixed axis *E*. Link *9* is connected by turning pairs *F* and *K* to lever *8* and to link *10*, which is attached to segment gear *11*. Gear *11* meshes with a gear rack of sleeve *12*. Upon an increase in the pilot pressure at the bottom of plunger *1*, the plunger is shifted upward, turning lever *2* about axis *A*. Lever *2* shifts valve spool *3* upward, delivering fluid to the space above piston *4*. This shifts valve spool *5*, rigidly attached to the piston, downward. At this, high-pressure fluid, delivered from the main to spool *5*, is directed to the right end of power cylinder *6*, which controls the flaps of the plane. From the left end of cylinder *6*, fluid is discharged through a groove of spool *5* to the tank. As spool *5* is shifted downward, it turns lever *2* about axis *D*, returning spool *3* to its neutral position. Thus, the system is transferred to a new state of equilibrium, determined by the magnitude of the pilot pressure. As piston *7* moves to the left, motion is transmitted through lever *8*, links *9* and *10*, and segment gear *11* to sleeve *12*. As the sleeve is shifted, it blocks off the connections between the ends of cylinder *6* and the high-pressure main and tank. Upon a decrease in pilot pressure, the elements of the system operate in the reverse direction.

4307	HYDRAULIC MECHANISM FOR TURNING AN AIRCRAFT NOSE WHEEL STRUT	CHP FD



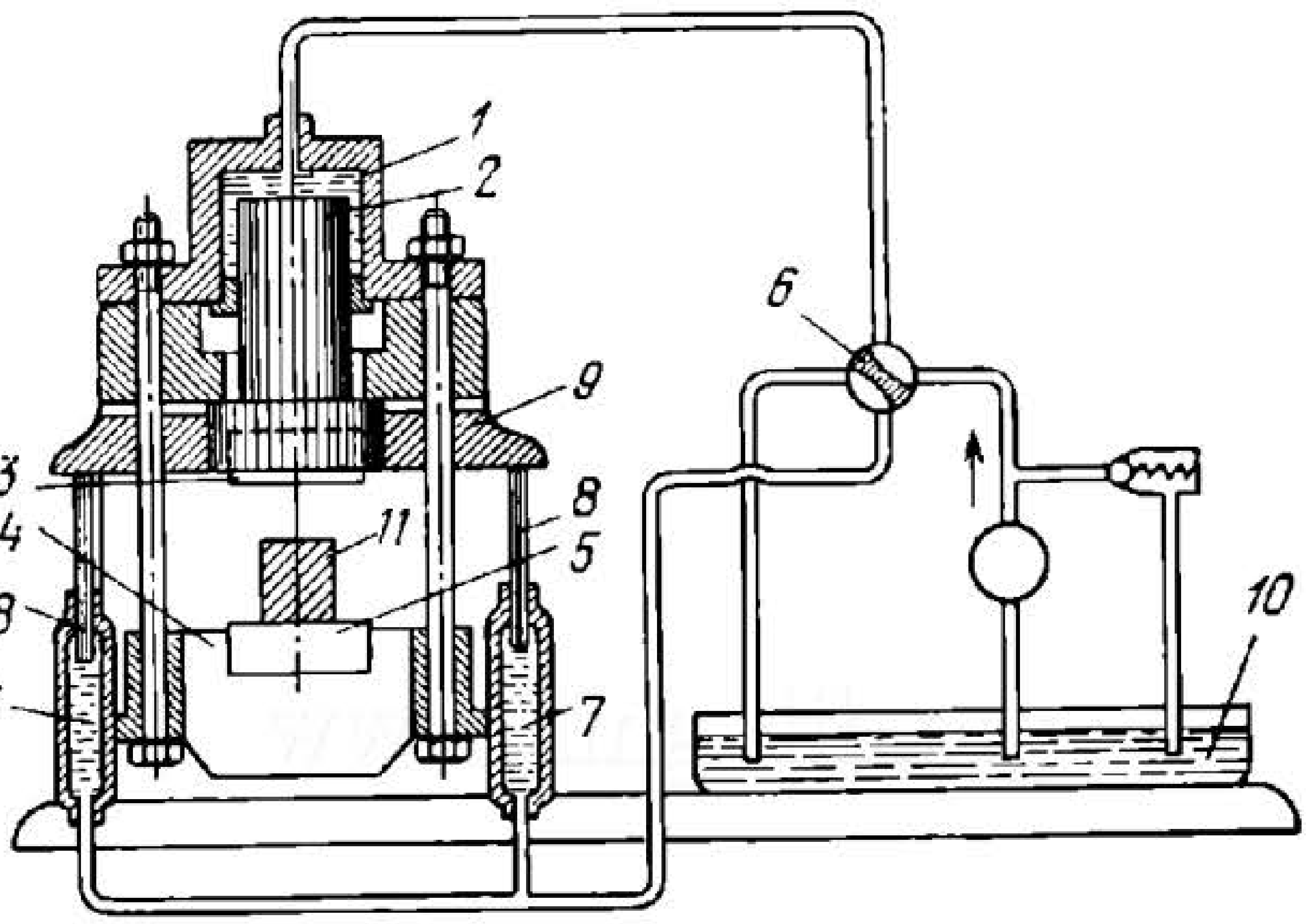
Strut *5* turns about fixed axis *A* and is connected by turning pairs *B* and *C* to links *6* and *7* which, in turn, are connected by turning pairs *D* and *E* to cylinders *1* and *2*. The lengths of the links comply with the conditions: $\overline{AB} = \overline{AC}$ and $\overline{BD} = \overline{CE}$. When hydraulic fluid is delivered to the right end of cylinder *1* and to the left end of cylinder *2*, the former moves to the right and the latter to the left, turning strut *5* of the nose wheel, through links *6* and *7*, clockwise. Rods *3* and *4* of pistons *b* and *a* are attached to a fixed frame. Fluid from the exhaust ends of the cylinders is discharged to the tank.

4308	HYDRAULIC DRIVE MECHANISM FOR AUTOMATIC WORKPIECE EJECTION	CHP FD



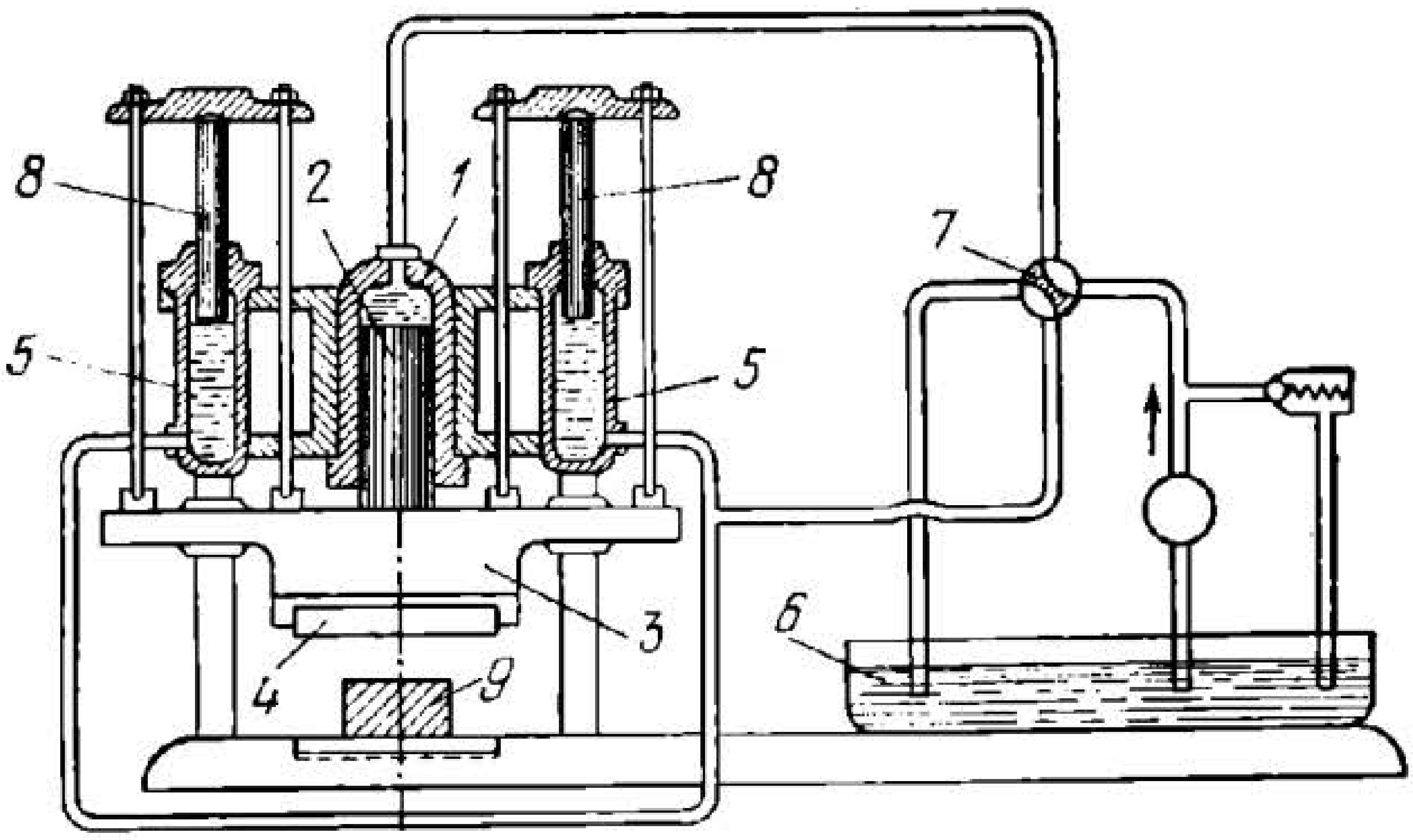
Pump *1* delivers fluid through valve *2*, controlled by lever *3*, to the right end of clamping cylinder *4*. This moves piston *5* to the left, clamping the workpiece (not shown). In this position of valve *2*, the right end of ejector cylinder *6* is connected to the tank. At the end of the machining operation, lever *3* is turned. Then, valve *2* connects the right end of clamping cylinder *4* to the tank and the right end of ejector cylinder *6* to the pump delivery line. Piston *7* and rod *8* move to the left, together with disk *9*, which carries pushers *10* that eject workpiece *14*. Spring *11* returns the pushers to the initial position, and spring *12* returns piston *5*. Relief valve *13* protects the system against overloads.

4309	HYDRAULIC MOVABLE BLADE MECHANISM FOR A SHEAR	CHP FD



Fluid under constant pressure is delivered through rotary directional valve *6* to operating cylinder *1*, and ram *2*, together with blade *3*, moves downward until the blade contacts billet *11*. At this, ram *2* ceases to descend and cylinder *1*, together with crosspiece *4* and bottom blade *5*, is moved upward by the pressure of the fluid which continues to be delivered into cylinder *1*. This motion shears billet *11* by blades *5* and *3*. To reverse blade *5*, valve *6* is turned so that fluid is delivered into cylinders *7*. The pressure of the fluid moves plungers *8* upward with crosspiece *9*. Fluid is discharged from cylinder *1* to tank *10*.

4310	HYDRAULIC MOVABLE BLADE MECHANISM FOR A SHEAR	CHP FD



Fluid under constant pressure is delivered through rotary directional valve *7* to operating cylinder *1*, and ram *2* together with shear head *3* and blade *4* descends, shearing billet *9*. At this, fluid from cylinders *5* is discharged to tank *6*. For the return stroke of blade *4*, valve *7* is turned. Then fluid is delivered to cylinders *5*. This moves plungers *8* with shear head *3* and blade *4* upward. Fluid is discharged from cylinder *1* to tank *6*.

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To the Reader

Mir Publishers would be grateful for your comments on the content, translation and design of this book. We would also be pleased to receive any other suggestions you may wish to make.

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